# THE IRON TRADE REVIEW

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## EASIER CONDITIONS

### ARE NOW NOTICEABLE IN SOME PRODUCTS.

### Demand for Shapes Decreased—Bar Iron Lower in Various Centers—Pig Iron Strong and Active at Chicago, but Quiet in Other Cities.

Well defined indications of easier conditions are noticeable this week. It was hardly to be expected that the astonishing demand for all iron and steel products which has prevailed for many months would be continued indefinitely. The change that seems to be setting in is not due to any extraneous causes, but merely to the fact that buyers have ordered far in advance and see no necessity for adding to their obligations. There is nothing at all alarming in the situation.

**Foreign Ore in Demand.** Eastern furnace interests are making contracts for large tonnages of foreign ore and there is also a disposition to use increased amounts of local eastern ores. Iron ore on Lake Erie docks at the close of navigation was about 200,000 tons less than at the same time last year.

**Pig Iron Conditions.** Pig iron is very strong at Chicago, where all of the merchant furnaces have sold fully two-thirds of their product for this year. Prices of southern pig iron continue firm with a tendency to advance, especially as reflected in the Cincinnati market, but in New York, Pittsburg and other centers comparatively little iron is being purchased. It is reported in New York that concessions have been made to one large interest which bought from 7,000 to 8,000 tons of foundry grades, and also that basic is selling at lower prices. Spot iron is very scarce in the Cleveland district, and a number of foundries have been compelled to close for a few days on account of lack of supplies. Foreign iron is quiet with prices not quite so strong. Delivery from southern furnaces continues very slow.

**Bar Iron Sagging.** Bar iron, which began to sag in February of last year, is showing a similar tendency this year, and competition for desirable tonnages has resulted in prices $4 to $5 lower than quotations that have prevailed recently. Steel bars are firm and in fair demand.

**Sheet Products.** Sheets continue strong and the cost of manufacturing the galvanized product is being increased by the fact that spelter is selling at higher prices than in many years. The total shipments of sheet products, including tin plate, by the American Sheet & Tin Plate Co. for the past year are estimated at 1,250,000 tons, an increase of 20 per cent over 1905. Railroads are considering the advisability of placing orders for plates for cars for 1908 delivery. Independent interests are obtaining large premiums for prompt delivery of plates, as high as $10 per ton premium being paid in some cases.

**Structural Material.** The demand for structural material has slackened to such an extent that the Illinois Steel Co. is operating its structural mill every alternate week on billets. The demand for shapes has decreased in some centers also, but improvement is noted at Pittsburg. San Francisco is at last appearing as an important buyer; since Jan. 1 orders aggregating about 7,000 tons for new buildings have been placed, and contracts for several other structures in that city are pending. The December sales of the American Bridge Co. were the heaviest of the past year with the exception of October, and the sales for the year aggregated 660,000 tons. Orders for steel for a number of skyscrapers in New York have been placed and some important bridge material contracts are pending.

**Cities Are Waiting.** Owing to high prices municipalities are slow in placing contracts for cast iron pipe, and the demand has decreased to a considerable extent. Sales of rails are confined principally to traction lines. Mild weather has tended to prevent higher prices on old material, and the market in most places is easier. The coke market continues firm, buying being principally for prompt shipment. Retarded delivery of coke in the Chicago district is still causing uneasiness.

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The large plant of the Michigan Stove Co., at Detroit, Mich., was damaged to the extent of $750,000. Jan. 8, by a fire which is believed to have originated from spontaneous combustion. Only the office building, the foundries and part of the storage building, less than one-third of the plant, which had covered an area of ten or twelve acres, were saved by the firemen. The plant was insured for $380,000. During the fire the horses attached to one of the fire engines ran away in the crowd of spectators, causing the death of one person and the serious injury of half a dozen others.

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Important changes have been announced by the Carnegie Steel Co., which became effective Jan. 1. Thomas McDonald has been made general superintendent of the Youngstown district; J. A. McDonald, superintendent of Ohio Steel Works and furnaces and Niles, O., furnaces; F. B. Baugh, superintendent of bar mill departments of Youngstown district; I. L. Hughes, assistant superintendent of bar mill departments of Youngstown district; John Oursler, general superintendent of New Castle and Sharon districts.

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Charles M. Wambaugh, president of the Columbus Chain Co., states that press reports of the recent fire in that plant were exaggerated, and that operations were resumed by the company Monday, Jan. 7.

# THE WEEK IN IRON CENTERS.

## PITTSBURG.

### Heavy Increase in Sheet Products.—Market is Settling.—Not so Active.

Office of THE IRON TRADE REVIEW.
521 PARK BUILDING, Jan. 9

The new year started out under very favorable conditions and there is not a single indication of a break in any direction. The situation may be a little bit quieter than it was during the holiday week, having settled to a steady even level with talk of slightly lower prices for future deliveries, especially on pig iron. Finished lines could scarcely be improved upon if conditions were made to order, mills being booked up practically to capacity for at least six months ahead and specifications are extremely heavy, making a very satisfactory situation throughout. The pressure upon the mills is so great that the output is being proportioned among the customers as evenly as possible. While no official figures are obtainable at this time, we estimate the total shipments of products including tin plate by the American Sheet & Tin Plate Co. for the year of 1906 at 1,250,000 tons, or an increase of practically 20 per cent over 1905. It is estimated that at least 100,000 tons of active rail orders were carried over by local mills into 1907.

**Pig Iron.**—During the past week, one sale of Bessemer pig iron, 3,000 tons, was made at $22.50 valley furnaces for second quarter delivery and the market for spot delivery is nominally $23. Second quarter basic iron is quoted $22 and last half Bessemer is quoted at $21.50. A fair tonnage of foreign foundry iron for February delivery, guaranteed shipment, sold at $25 delivered. Southern foundry iron is quoted at $22 Birmingham for second quarter delivery and $19 for last half. What buying has been done during the past two weeks has been of a very quiet nature, consumers being unwilling to appear openly as buyers at this time. There is practically no spot iron to be had and the inquiries for last half on both foundry and steel making irons have been more in the nature of feelers than actual inquiries. On second quarter delivery we quote as follows:

| | |
|---|---|
| Bessemer Valley | 22.50 to 23.00 |
| Bessemer, Pittsburg | 23.35 to 23.85 |
| No. 1 Foundry, Pittsburg | 24.35 to 24.60 |
| No. 2 Foundry, Pittsburg | 23.85 to 24.35 |
| Gray Forge, Pittsburg | 22.85 to 23.35 |
| Basic, Valley | 22.00 to 22.50 |
| Basic, Pittsburg | 22.85 to 23.30 |

**Ferro-Manganese.**—The alloy market has been comparatively quiet with prices for advance delivery showing a downward tendency with one quotation for April delivery being $76, Atlantic seaboard and considerable ferro-manganese for this delivery is being offered. There has been no change on spot delivery and we quote $80 to $82.50. Imported ferro-silicon 50 per cent is quoted $108 to $110, 12 per cent $36, and 11 per cent $1 less.

**Muck Bar.**—All pig metal muck bar is quoted nominally at $37 Pittsburg and part scrap bar $33.50 to $34.

**Steel.**—There is little or no semi-finished steel to be had in the open market, in fact, the leading interest for several months past has refused to take on anything but continuation of old contracts, refusing to accept any new business whatever in billets or sheet bars and other interests are in much the same condition. This scarcity has given an idea of a much higher market than really exists and we quote $30 nominal on 4 x 4 soft Bessemer billets, $32 to $33 on open-hearth billets, sheet bars on contract are quoted $30, although as high as $33 has been paid for odd lots and reasonable prompt delivery.

**Skelp.**—There is no real market on skelp and prices given are nominal on light guages and narrow widths, with the usual differentials on heavier stocks. Producers are practically sold up on contract and have no material to offer. We quote:

Bessemer grooved, 1.70c to 1.75c; sheared, 1.70c to 1.75c; basic, grooved, 1.80c to 1.85c; sheared, 1.75c to 1.85c; iron skelp, 2.15c to 2.25c.

**Plates.**—No attention is being paid in the Pittsburg district to the 1.80c base prices being made by eastern mills. Although very little business is being accepted on account of the filled up condition of the mills, the 1.70c base is still the official Pittsburg price. The railroad companies are figuring on their 1908 new cars and there has been some talk of placing plate business for this far future delivery in order to insure material for car business already placed and in prospect. The steel car companies are making urgent appeals for plates and small shapes and work is being held back at their plants on account of the comparatively limited supply of material, due to the heavy demands from other sources, chiefly the lake ship yards and the steel pipe interests. We quote as follows:

Tank plate ¼-inch thick, 6¼ to 100 inches, 1.70c f. o. b. mill, Pittsburg. Light plate schedule, No. 10, 1.80c; Nos. 11-12, 1.85c; Nos. 13-14, 1.90c; Nos. 15-16, 2c. Extras on the regular plate schedule are as follows per 100 pounds: boiler and flange steel plates 0.10c; A. B. M. A. and ordinary firebox steel plates, 0.20c; still bottom steel, 0.30c; marine steel, 0.40c; locomotive firebox steel, 0.50c; all sketches, excepting straight taper plates varying not more than four inches in width at ends, narrowest end not being less than 30 inches, 0.10c; complete circles, 0.20c. Plates in width over 100 inches up to 110 inches, 0.05c; over 110 inches up to 115 inches, 0.10c; over 115 inches up to 120 inches, 0.15c; over 120 inches up to 125 inches, 0.25c; over 125 inches up to 130 inches, 0.50c; over 130 inches, 1.00c. Gauges under ¼-inch to and including 3-16-inch plates on thin edges, 0.10c; under 3-16 inch to and including No. 8, 0.15c; under No. 8 and including No. 9, 0.25c. Five cents extra for less than carloads. Terms, net cash in 30 days.

**Sheets.**—The galvanized sheet market is particularly strong on account of active demand, as well as the strength displayed in the spelter market, which is now about $6.70 East St. Louis, with a further advance probable at any time. This is the highest spelter quotation in recent years, and in the natural order of things is likely to bring about an advance in the prices of galvanized sheets. The best deliveries on galvanized sheets at this time is 14 to 16 weeks. The American Sheet & Tin Plate Co. has decided to install five new galvanized pots at its Scottdale, Pa., plant. Prices in this district are very strong, but a cut of $1.00 a ton has been reported by central western mills for delivery into western territory. On account of the scarcity of semi-finished material, the leading interest is operating at less than 80 per cent of its capacity. We quote:

Black steel sheets, one pass, cold rolled: Nos. 11-12, 2.20c; Nos. 13-14, 2.25c; Nos. 15-16, 2.30c; Nos. 17-21, 2.35c; Nos. 22-24, 2.40c; Nos. 25-26, 2.45c; No. 27, 2.50c; No. 28, 2.60c; No. 29, 2.75c; No. 30, 2.85c; galvanized, Nos. 10-11, 2.55c; Nos. 12-14, 2.65c; Nos. 15-16, 2.75c; Nos. 17-21, 2.90c; Nos. 22-24, 3.04c; Nos. 25-26, 3.25c;

No. 27, 3.45c; No. 28, 3.65c; No. 29, 3.90c; No. 30, 4.15c. Corrugated roofing, $1.85 per square for No. 28 painted, 2½ inch corrugation and $3.15 per square No. 28 galvanized, 2½ inch corrugation. Blue annealed sheets, No. 10 and heavier 1.80c; Nos. 11-12, 1.85c; Nos. 13-14, 1.90c; Nos. 15-16, 2c.

**Tin Plate.**—The actual new business in tin plate being received by the mills amounts to practically nothing, but the mills are operating to the extent the supply of semi-finished material will permit them in order to make deliveries on old contracts. The year started in with no stocks worth mentioning, the only accumulation being brought about by car shortage. We quote:

Coke tin plate, 100-pounds basis, 14 x 20, $3.90 f. o. b. mill, Pittsburg district. Terms, 30 days, less two per cent for cash in 10 days.

**Hoops and Bands.**—Mill shipments are running about even with specifications against old contracts, but there is no new business being done, and not much is expected before April, the beginning of the contract period for the remainder of the year and also for 1908. There is a very heavy tonnage on the books and producers are comfortable. We quote as follows:

Hoops, in carload lots, 2c; in less than carload lots, 2.10c; bands, 1.60c base, half extras as per standard steel card. Prices f. o. b. Pittsburg.

**Merchant Bars.**—The new buying has practically stopped and aside from very heavy specifications, the new business consists of supplementary orders from customers for additional tonnage. Producers of steel bars are very frank with the trade on promised delivery and if all the tonnage now contracted for is specified against, the leading interest could operate full until practically the end of the year without taking on additional obligations. Bar iron is moving slowly and about the only current business is the usual first of the month tonnage of the railroads. We quote as follows:

Common iron bars, 1.85c Pittsburg in carload lots and over 1.90c in less than carloads; Bessemer steel bars, 1.60c, net; plow and cultivator, 1.60c, net; channels, angles, zees, tees, under three inches, 1.70c, all f. o. b. Pittsburg. The following differentials are maintained on steel: less than 2,000 pounds, 0.10c advance; less than 1,000 pounds of a size 0.30c advance. Cold rolled and ground shafting, 50 per cent off in carload lots, and 5 per cent off in less than carloads, delivered in base territory; open-hearth spring steel, 2.25c to 2.50c, sleigh shoe flats, 1.60c to 1.65c; smooth finished machinery steel, 1.90c to 2c; toe calk, 2.10c to 2.15c. The price of planished and machine straightened tire is 1.80c, base, half tire extras. Iron finished tire up to 1½ inch and over to be sold on regular bar basis of 1.60c base, half extras, steel card.

**Rails and Track Material.**—A conservative estimate on the standard rail tonnage carried over into the new year by the leading local interest is 100,000 tons of active business, and the tonnage, delivery time for which has expired, and upon which no new delivery date has been made, will probably amount to 30,000 or 40,000 tons more. The leading interest is now quoting five months as the best delivery on both light and standard sections. The new business for the current week has not been heavy and the tonnage is scarcely worth mentioning. Shipment figures for 1906 have not yet been compiled. A few days before the first of the year, an advance of $1.00 was made on light rails. We quote:

50 pound and heavier, 500-ton lots and over, $28.00; carload and less than 500 pound, $30; less than carload lots, $32; 8 pound, $40; 12 pound, $36 to $37; 16 pound, $35 to $36; 20 pound, $34 to $35; 25 to 45 pound, $33 to $34; angle splice bars for standard sections, $1.65; spikes, for forward delivery, $2.50 to $2.75.

**Structural Material.**—There has been a marked improvement in the demand for structural material and still further improvement is expected with the approach of spring and building weather. Deliveries at the present time are very good and the full range of rollings can be secured in from six to eight weeks without difficulty. Prices are very firm and we continue to quote as follows:

Beams and channels, 15 in., and under, 1.70c; over 15 in., 1.80c; zees, 1.70c; tees, 1.70c; angles from three to six inches, inclusive, 1.70c; over six inches, 1.80c; universal and sheared plates, 6¼ inches and wider, 1.60c base.

**Wire and Wire Nails.**—The situation has not changed in this market for several weeks past, and very heavy demands for deliveries and heavy specifications against contracts continue unabated. Prices are unchanged and we quote as follows:

Wire nails, jobbers' carload lots, $2; retailers' carload lots, $2.05; less than carloads $2.10; painted barb wire, $2.15, for jobbers in carloads; retailers in carloads $2.20; and less than carloads, $2.30, with 30c. for galvanizing; plain wire, $1.85 for jobbers and $1.90 by carload.

**Merchant Pipe.**—The conditions in the pipe market have not changed and the trade is expecting a further advance in merchant pipe on account of the high prices of semi-finished material. Present prices are being firmly adhered to, jobbers' discount being 77 basing, base sizes and 5. Consumers' carloads best discounts are as follows:

| | Steel black | galv. |
|---|---|---|
| ⅛ to ¼ inch | 67 | 51 |
| ⅜ inch | 69 | 55 |
| ½ inch | 71 | 59 |
| ⅝ to 6 inches | 75 | 65 |
| 7 to 12 inches | 70 | 55 |
| EXTRA STRONG PLAIN ENDS. | | |
| ⅛ to ⅜ inch | 60 | 48 |
| ½ to 4 inches | 67 | 56 |
| 4½ to 8 inches | 63 | 51 |
| Double extra strong plain ends, ⅛ to 8 inches | 56 | 45 |

**Boiler Tubes.**—Specifications against contracts are very heavy, but there has been no intimation of further increase in price on new business, although such an advance would not surprise the trade.

| Boiler tubes. | Steel | Iron |
|---|---|---|
| 1 to 1¼ inches | 48 | 48 |
| 1½ to 2¼ inches | 60 | 48 |
| 2½ inches | 62 | 48 |
| 2¾ to 5 inches | 65 | 55 |
| 28 to 13 inches | 60 | 48 |

Less than carloads two points less.
2½ inches and smaller, over 18 feet, 10 per cent, net, extra.
3 inches and larger, over 22 feet, 10 per cent, net extra.

**Wrought Iron Pipe.**—The market continues its rapid advance and the probable minimum is now 71 off, though it is understood that one producer bought a considerable tonnage at 72 off. We quote jobbers' carloads:

| | Card Weight black | galv |
|---|---|---|
| ⅛, ¼ and ⅜ inch | 62 | 46 |
| ½ inch | 65 | 54 |
| ¾ to 4 inch | 70 | 60 |
| PLUGGED AND REAMED. | | |
| 1 to 4 inch | 64 | 58 |
| EXTRA STRONG PLAIN ENDS. | | |
| ⅛, ¼ and ⅜ inch | 55 | 43 |
| ½ to 4 inch | 62 | 50 |
| DOUBLE EXTRA STRONG. | | |
| ½ to 4 inch | 51 | 40 |

**Coke.**—There has been very little activity in the coke market during the week under review. The demand for foundry coke is light as expected at this time of the year, but prices are firm. Furnace coke is strong at unchanged prices, and in some instances furnaces are asking producers to anticipate on contract and are buying up the available spot coke. On standard Connellsville foundry coke we quote $4.00 to $4.25 for shipment during the first half, and $3.85 to $4.00 on contract during the year. Furnace coke is quoted at $3.75 to $3.85 for spot shipment and $3.10 to $3.25 for the year.

**Old Material.**—There is a good healthy undertone to the scrap market, and while there have been some lower

prices, especially in steel scrap, there is no pronounced weakness, the selling being chiefly by brokers trying to unload their accumulation as a result of speculation and prospects of a closed winter. These brokers are now disposing of this material, transactions being confined practically to dealers. We quote as follows, delivered Pittsburg district:

Heavy melting scrap, $19 to $19.50; re-rolling rails, $21.50 to $22; bundled sheet scrap, $16 to $16.50; iron axles, $31 to $31.50; old iron rail, $26.50 to $27. No. 1 wrought scrap, $20.50 to $21.00; old car wheels, $23.50 to $24.00; low phosphorus scrap, $23.50 to $24; machine shop turnings, $15 to $15.50; axle turnings, $16.25 to $16.75; cast borings, $12.25 to $12.50; No. 1 cast scrap, $20.50 to $21.

## CHICAGO.

### Decreased Demand for Shapes.—Pig Iron Market Very Strong.

Office of THE IRON TRADE REVIEW, 1362 MONADNOCK BLOCK, Jan. 9

Demand for structural material has fallen off to such an extent that the Illinois Steel Co. can fill its current specifications with one-half its normal output, and in consequence is operating its structural mill every alternate week on billets. While this feature is unsatisfactory from one standpoint, the change is not without its compensating element in view of the marked scarcity in the local market of the intermediate product. The shortage of specifications for structural steel is generally felt, but is not unusual for the time of the year, though it is made more prominent by the large increases to capacity that have been completed in the past twelve months. For every other form of finished material, excepting possibly cast iron pipe, the demand is insatiate.

The car shortage continues a harrassing feature of the situation, and is seriously delaying the shipment of material urgently needed. At South Chicago the congestion resulting from the accumulation of stocks threatens to hamper the rolling program of the entire plant. Cast iron pipe is quiet because of the prevailing high prices, many municipalities having postponed projected improvements in the hope that the market will later present a more favorable opportunity for purchasing the requirements. Pig iron does not show any evidence of weakening, however, on the contrary, a steady advance in prices is predicted. For the first quarter, southern foundry grades are again selling above northern, the spread between the two products amounting to 85 cents.

**Pig Iron.**—Unwonted activity for the last half continues. All classes of melters from all sections of this territory are freely covering for their wants in that period. The buying movement is in the nature of a landslide, and a runaway market is greatly feared. Many sellers are of the opinion that prices will reach a higher level this quarter than in any period since the Civil war. Every indication points to this probability. Stocks in southern furnace yards do not exceed 70,000 tons, all of which is urgently needed on contracts; deliveries are so far behind that it is almost impossible to hope the delinquency will be overtaken in time to relieve the situation, while hope for improvement in the car shortage before the end of winter has been well nigh abandoned. In the north, deliveries are more prompt, but there is not a merchant furnace in this locality that has not two-thirds of its 1907 output under contract. Furthermore, local stacks are facing a shortage in coke due to the inefficient shipping facilities at producing points and serious curtailment of output must ensue unless consignments are soon increased. Schedules are revised almost every other day, two advances having been made in the week under review. Each furnace quotes according to the individual conditions confronting it, the spread between the highest and lowest prices offered reaching as high as $1.50. Deliveries in the entire first quarter are now considered as spot shipment and the price ranges from $23 to $24.50 Birmingham. For the second quarter $21 Birmingham is the minimum price for No. 2 foundry, though some producers are asking $22; for the third quarter $19.50 Birmingham is asked; $18.50 for the fourth quarter, and $19 for the last half. Northern No. 2 foundry for the last half is quoted at $22 to $22.50, Chicago; for the third quarter $22.50 to $23 Chicago. Second quarter requirements are held at $25 Chicago, and for the first quarter from $26 to $27 Chicago. Each day seems to bring an increasing inquiry for the first half, indicating the unprotected requirements for this period are very heavy. One sale of 1,000 tons of southern No. 2 foundry for spot shipment was made at $23.50 Birmingham, while Lake Superior charcoal for spot delivery has sold as high as $29 Chicago. The quotations on southern irons given below are for delivery after Feb. 1 and include the new Birmingham freight rate of $4.35 effective that date. The maximum prices are for second quarter, the minimum for third quarter.

| | |
|---|---|
| Lake Superior charcoal | $26.00 to 27 00 |
| Northern Foundry No. 1 | 24.00 to 25 50 |
| Northern Foundry No. 2 | 22.50 to 25.00 |
| Northern Foundry No. 3 | 22.00 to 24.50 |
| Northern Scotch Foundry | 23.00 to 25.00 |
| Ohio Strong Softeners No. 1 | 26.30 |
| Ohio Strong Softeners No. 2 | 25.80 |
| Southern Foundry No. 1 | 24.35 to 25.85 |
| Southern Foundry No. 2 | 23 85 to 25.35 |
| Southern Foundry No. 3 | 23 35 to 24 85 |
| Southern Foundry No. 4 | 22.85 to 24 35 |
| Southern No. 1 Soft | 24 35 to 25-85 |
| Southern No. 2 Soft | 23 85 to 25.35 |
| Southern Gray Forge | 22 35 to 23.85 |
| Southern Mottled | 21 10 to 23.60 |
| Southern Silveries 4 per cent to 6 per cent Silicon | 27.40 to 29.90 |
| Jackson Co. Silveries, 8 to 10 per cent Silicon | 32.30 to 33.30 |
| Malleable Bessemer | 22.50 to 25.00 |

**Billets and Rods.**—With chain and wire rods selling at $41 Chicago and forging billets as high as $42 Chicago, some idea of the condition under which western consumers and producers are operating may be formed. Both products are very scarce at these prices, eastern manufacturers taking the bulk of the business offered. During the present lull in the demand for structural shapes, the Illinois Steel Co. is operating its structural mill on billets every alternate week. This increased output will relieve the shortage to some extent in the local market.

**Iron and Steel Bars.**—Competition for desirable bar iron tonnage has brought out prices as low as 1.60c Pittsburg from local mills. For the general run of business, however, the market is firm at 1.65c, and for quick shipment, 1.70c Pittsburg is asked. There is a good demand from every consuming source, and mills are comfortably filled for the first half of the year. Specifications and new tonnage for steel bars continue heavy. The Illinois Steel Co. is filled up for the year and is diverting tonnage to the eastern plants of the Steel Corporation. Jobbers report a brisk movement from stock, and owing to the difficulty experienced in replenishing there is a tendency towards higher prices. We quote as folows:

Soft steel bars and bands, 1.76½c, half extras; soft steel angles, less than 3 x 3, 1.86½c; hoops, 2.16½c base, full extras; old rail stock, 1.70c. We quote bar iron from stock, 2.20c; full extras; soft steel rounds and squares, 3 inches and larger, $2 per 100 pounds base; flats, 2 inches to 4 inches by 1⅛ inch and larger, $2 per 100 pounds base; 4½ inches x 5 inches and 6 inches x 5-16 inch and thicker, $2 per 100 pounds base; all ovals, half rounds, $2 per 100 pounds base; steel bands, $2.00, half extras; soft steel hoops, 2.40c to 2.50c full extras. Other sizes not mentioned above, $2 per 100 pounds base plus half extras.

**Sheets.**—There is a stiff demand for sheets in the way of both new tonnage and specifications. Deliveries continue slow owing to the car short-

age and scarcity of steel. Despite the rumors to the contrary, no advance has yet been made, although premiums of $1 a ton are paid for quick shipments. Local jobbers have advanced galvanized sheets from stock $1 a ton. We quote carload lots, as follows:

Black sheets, Nos. 8, 9 and 10, 1.85c Pittsburg; No. 28 gauge, 2.60c Pittsburg. Galvanized sheets No. 28 gauge 3.65c Pittsburg. Freight to Chicago 16½c per 100 pounds. Jobbers' prices on less than carload lots from store are as follows: Black sheets, No. 10, 2.20c to 2.30c; No. 12, 2.25c to 2.35c; No. 14, 2.30c to 2.40c; No. 16, 2.40c to 2.50c; Nos. 18-20, 2.70c to 2.80c; Nos. 22-24, 2.75c to 2.85c; No. 26, 2.80c to 2.90c; No. 27 2.85c to 2.95c; No. 28, 2.95c to 3.05c; No. 30, 3.35c. Galvanized sheets, Nos. 10 to 20, 3.30c to 3.35c; Nos. 22 and 24, 3.45c to 3.50c; No. 26, 3.65c to 3.70c; No. 27, 3.85c to 3.90c; No. 28, 4.05c to 4.10c; No. 30, 5.25c to 5.30c

**Plates.**—Specifications exceed the capacity of local mills. New tonnage offered the Illinois Steel Co. is diverted to the Carnegie Steel Co. because of the completely sold up condition for 1907 of the former mill. Prices are very firm, but are without change as follows:

Tank steel, ¼-inch and heavier, up to 100 inches wide, 1.60c to 1.60c Pittsburg base. For extras see Pittsburg report. Freight rate to Chicago is 16½c per hundred pounds.

Jobbers' prices for shipment from local stocks are as follows: Tank steel ¼ inch and heavier, up to 72 inches wide, 2.10c; 72 inches up to 96 inches wide, 2.20c; 3-10 inch up to and including 60 inches wide, 2.20c; 3-16 inch, 72 inches wide, 2.45c; No. 8, up to 60 inches wide, 2.25c; flange steel, 25c extra; heads, 25c extra.

**Structural Steel.**—Neither of the contracts pending for railroad bridge material, aggregating 10,000 tons, has been closed, though both are expected to be allotted this week. The contract for the erection of the new power plant for the Chicago and Milwaukee Electric railway, involving about 2,000 tons, has been let to the South Halstead Street Iron Works, of this city. The Schroth building, San Francisco, which will require about 900 tons of structural shapes, is now being figured on by local fabricators. Inquiry for structural shapes on local mills is very quiet. The Illinois Steel Co. has so few specifications in hand, that it is operating its structural mill at South Chicago every alternate week on billets. Both mill and jobbers' prices are firm, nevertheless. We quote as follows:

Beams and channels, 3 to 15 inches inclusive, 1.70c Pittsburg. For extras see Pittsburg report. Freight rate from that city to Chicago is 16½c per 100 pounds. Quotations from store are as follows:

All angles, three inches and larger, including six inches, $2.05 to $2.10 per 100 pounds; angles over six inches, $2.15 per 100 pounds base; beams, three inches to 15 inches, inclusive $2.05 to $2.10 per 100 pounds base; channels, three inches and larger, $2.05 per 100 pounds base. Less than carload lots are $2 a ton higher than foregoing price.

**Rails and Track Supplies.**—Local manufacturers report a good demand for light rails and bolts. The Illinois Steel Co. is sold considerably ahead on the former product and its daily specifications exceed its output. The week has been quiet on standard sections. Pennsylvania independent interests continues to ask $30 a ton for heavy rails in lots of 500 tons and over, and $32 a ton for smaller quantities. No change has been made by the Steel Corporation in its prices. We quote as follows:

Bessemer rails, $28 to $30; less than 500-ton lots, $32; open-hearth rails, $29; light rails, Bessemer, 30 to 45-pound sections, $33; 25-pound, $34; 20-pound, $35; 16-pound, $36; 12-pound, $37, and lighter sections down to 8-pound, $43.50, all f. o. b. mill. Track supplies vary in price according to quantity and delivery. Angle bars in large lots are quoted 1.65c to 1.75c; for smaller quantities, 2.25c to 2.75c; spikes, large lots, 2.25c; for smaller quantities, 2.50c; bolts, large lots, 2.65c to 2.75c; smaller lots, 2.85c with square nuts, and 3c with hexagon nuts.

**Merchant Steel.** — Specifications against existing contracts are both voluminous and heavy. No inquiry is felt for forward requirements. Demand for shafting is more insistent, and prices are firmer than in many months. We quote carload lots, Chicago deliveries, as follows:

Planished or smooth finished tire steel, 1.96½c; iron finish, up to 1½ x ½ inch, 1.91½c; base iron finish 1½ x ½ inch and larger, 1.76½c, base; channels for solid rubber tires, ¾ to 1 inch, 2.26½c, and 1⅛ inch and larger, 2.16½c; smooth finished machinery steel, 2.01½c; flat sleigh shoe, 1.81½c; concave and convex sleigh shoe, 2.06½c; cutter shoe, 2.35c; toe calk steel, 2.31½c; railway spring, 1.96½c; crucible tool steel, 6½c to 8c, and still higher prices are asked on special grades. Shafting is very strong and an advance is expected. Quotations are without change at 50 per cent off in car lots and 45 per cent in less than car lots, in base territory.

**Cast Iron Pipe.**—The reason for the light inquiry for this product is attributed to the high level of prices. No specification of large moment has come up since the Minneapolis inquiry for 2,000 tons. This will be let Wednesday, this week. Prices are without change, as follows: 4-inch water pipe, $37; 6, 8, 10 and 12-inch, $36; gas pipe, $1 a ton higher.

**Merchant Pipe.**—Mills are crowded with specifications and deliveries are slow, owing to the car scarcity. Prices are without change. We quote mill shipments, Chicago delivery, as follows: ¾ to six inch black steel pipe, 75.35 per cent discount; galvanized, 65.35 per cent discount. From store in small lots, Chicago distributors are asking 72 to 73 per cent discount on the base sizes.

**Boiler Tubes:**—There is little change in the local situation. Demand is excellent and prices are firmly maintained. On carloads made up of odd sizes, deliveries are slow. We quote official discounts, carload lots, Chicago delivery, as follows: 2¾ to five inches, steel, 66.35c; iron 53.35c. On less than carload lots from store we quote 58 per cent off for steel; 45½ for iron, and 42½ for seamless tubes.

**Coke.**—The slow delivery of coke into this market from Connellsville and West Virginia producing points portends serious irregularity to the operation of local plants. Despite the open weather that prevails, no improvement has been made, and a condition bordering on famine already exists. Spot coke is in urgent demand, and for such as can be obtained, $4.50 ovens is easily secured. The by-product ovens in the west have had their entire output for this year under contract for some months, and their quotations of $6.65 to $7.15 are largely of a nominal character.

**Old Material.**—The open weather that prevails is a strong preventative towards improvement in the local scrap market. The speculative prices that have ruled for some time are rapidly vanishing, and more reasonable quotations are now appearing. Iron mills, however, are buying very little and the downward tendency is expected to continue until the weather changes. Cast scrap is scarce, resulting in a firmer market on this product. We have revised our prices, and quote gross tons in the first paragraph as follows:

| | |
|---|---|
| Old Steel Rails (4 feet and over) | $19.50 to 20.50 |
| Old Steel Rails (less than 4 feet) | 19.00 to 19.50 |
| Old Car Wheels | 24.75 to 25.50 |
| Old Iron Rails | 28.00 to 28.50 |
| Relaying Rails, subject to inspection | 29.00 to 30.00 |
| Frogs, Switches and Guards | 17.50 to 18.00 |
| Heavy Melting Steel | 17.00 to 17.50 |
| Mixed Country Steel | 14.50 to 15.00 |

**We quote net tons, as follows:**

| | |
|---|---|
| No. 1 R. R. Wrought | $17.00 to 17.50 |
| No. 2 R. R. Wrought | 16.00 to 16.50 |
| Shaft [illegible] | 18.50 to 19.00 |
| Dealers' forge No. 1 | 13.00 to 13.50 |
| Wrought Pipe and Flues | 12.50 to 13.00 |
| No. 1 Cast, 150 pounds and less | 18.00 to 18.50 |
| No. 1 Mill | 10.50 to 11.00 |
| Mixed Busheling (No. 1 & No. 2) | 12.00 to 13.50 |
| Country Sheet | 9.00 to 9.50 |
| No. 1 Boilers Cut | 12.50 to 13.00 |
| Boiler Punchings | 16.00 to 16.50 |
| Iron Car Axles | 27.00 to 27.50 |
| Steel Car Axles | 23.00 to 23.50 |
| Iron Axle Turnings | 11.50 to 12.00 |
| Cast Borings | 9.00 to 9.50 |
| Mixed Borings, etc. | 9.00 to 9.50 |
| Machine Shop Turnings | 11.00 to 11.50 |
| Railroad Malleable | 17.50 to 18.00 |
| Agricultural Malleable | 16.50 to 17.00 |
| Stove Plate and Light Cast Scrap | 14.50 to 15.00 |
| Old Iron Splice Bars | 22.00 to 22.50 |

## CLEVELAND.

### Very Small Supply of Spot Iron.—Foundries Compelled to Close.

Office of THE IRON TRADE REVIEW, BROWNING BUILDING, Jan. 8

**Iron Ore.**—The winter is witnessing the usual activities on the ore ranges in preparation for what is expected to prove another record breaking season. Mining operations are as extensive as conditions will permit. The amount of ore on lower lake docks at the close of navigation is announced as 6,252,455 tons, about the same as at the close of the season of 1905. Nominal quotations are: Old Range Bessemer, $5.00; Mesabi Bessemer, $4.75; Old Range non-Bessemer, $4.20; Mesabi non-Bessemer, $4.00.

**Pig Iron.**—Although selling is almost entirely confined to last half iron, the fact that foundries are hard pressed for immediate supplies is keeping the spot iron market in the forefront. There is practically no domestic iron available for prompt shipment, and prices are higher, $28 Cleveland being paid recently for a carload of No. 2 foundry. Foreign iron is increasingly scarce and it is stated that no more will be received in this district before the second week in February, and that even then the tonnage will be limited. A number of foundries have been forced to close for a few days at a time and the general rule is that stocks in yards are practically nothing. Foundrymen are complaining that the present level of prices is proving a heavy burden because of the fact that they are not able to advance the price of castings in proportion. This, they explain, is because some few competitors operating on low-priced iron would be able to undersell them if the full benefit of the advance were demanded. There is a remarkable heavy selling movement for the last half at prices unchanged. No recent Bessemer sales are reported in this district, but basic is active, one lot of 12,000 tons for last half going at $21 valley furnace. The new stack of the Toledo Furnace Co. is making iron. For second quarter we quote, f. o. b. Cleveland, as follows:

| | |
|---|---|
| Bessemer | $22.35 to 23.35 |
| No. 1 Foundry | 23.50 to 24.50 |
| No. 2 Foundry | 23.00 to 24.00 |
| No. 3 Foundry | 22.50 to 23.50 |
| No. 2 Southern | 23.35 to 23.85 |
| Gray Forge | 21.00 to 22.00 |
| Lake Superior charcoal | 26.00 to 27.00 |

**Coke.**—The supply is increasingly scarce with foundry coke selling at $4.15 to $4.25 and furnace coke at $3.65 to $3.85 ovens.

**Finished Materials.**—The advance in standard Bessemer sections to $30 mill, recently made by the Cambria and Pennsylvania steel interests, holds good on all rails which may be sold for any delivery by these two concerns. The former company has its output under contract until well through August, and the advance is not in the shape of a premium on quick deliveries, as has been reported since its exclusive announcement in these columns a week ago. An eastern Pennsylvania mill catering to quick delivery business has announced another increase of $2 per ton in its price on plates and is now holding at 2.10c Pittsburg, as compared with 1.60c Pittsburg, which remains the quotation of the leading producer. Frequent shading of bar iron prices is reported on the part of Indiana mills, though the leading interest is still holding at 1.80c Pittsburg. Local mills are sold well ahead and are securing 1.80c Cleveland, while jobbers are holding 1.95c out of stock. The only weak feature of the situation is in structurals where an assortment can be secured from mills in from three to eight weeks. There is some activity in billets at $38 Pennsylvania mills.

**Old Materials.**—Occasional buying by consuming interests and a heavy trading movement among dealers have infused considerable activity into the situation, which is somewhat more firm than a week ago. Though there may be continued sagging for some time, no heavy decline is expected. We quote Cleveland delivery, gross tons in the first paragraph, as follows:

| | |
|---|---|
| Old iron rails | $27.00 to 27.50 |
| Old steel rails (over 6 feet) | 20.00 to 20.50 |
| Old steel rails (under 6 feet) | 19.00 to 20.00 |
| Old car wheels | 21.00 to 21.50 |
| Steel boiler plate | 16.00 to 16.50 |
| Steel axles | 21.00 to 22.00 |
| Malleable iron (railroad) | 19.50 to 20.00 |
| Malleable iron (agricultural) | 15.50 to 16.00 |
| Heavy steel | 17.50 to 18.00 |
| Country mixed steel | 15.50 to 16.00 |
| Low phosphorus | 24.00 to 25.00 |

**We quote net tons as follows:**

| | |
|---|---|
| No. 1 R. R. wrought | $18.50 to 19.00 |
| No 1 busheling | 15.50 to 16.00 |
| No. 1 machine cast | 18.50 to 19.00 |
| Iron axles | 26.00 to 27.00 |
| Axle turnings | 14.00 to 14.50 |
| Wrought turnings (free from cast) | 12.00 to 12.50 |
| Grate bars | 14.50 to 15.00 |
| Pipes and flues | 15.00 to 15.50 |
| Tank iron | 12.50 to 13.00 |
| Hoop and band iron | 9.00 to 9.50 |
| Sheet iron | 9.00 to 9.50 |
| Wrought drillings | 12.00 to 12.50 |
| Stove plate | 14.50 to 15.00 |
| Cast borings | 9.50 to 10.00 |

## CINCINNATI.

### Leading Cast Iron Pipe Interest Inquires for Prices on Pig.—Market Strong.

January 8.

**Pig Iron.**—The inquiry the past week and the sales have been of good volume. Business is being done for deliveries in all periods from prompt shipment to last half of the year. Second quarter delivery southern iron is slightly higher and sales of last half delivery have been made at slightly higher figures for both northern and southern brands. A feature of irregularity in prices is developing in the price differences between the grades. The high grades are firm, but as the orders are mostly for No. 2, furnaces are willing in some instances to make a concession on No. 3, No. 4 and gray forge. This is especially true in regard to the near-by deliveries. For prompt shipment southern iron there is a difference of one dollar per ton between No. 2 and No. 3 and one dollar between No. 3 and No. 4 and one dollar between No. 4 and gray forge. These differences are not carried to an important extent into the last half of year, but for deliveries in the first half the usual fifty cents difference between the lower grades is not being adhered to in all cases. It is believed in the trade, however, that special figures could be obtained for all deliveries on low grades. The most important inquiry is for 15,000 tons of foundry iron for last half of the year for a manufacturer in central Ohio. A sale of 6,000 tons of southern Ohio malleable iron at $22.00 furnace, for last half delivery is reported. The leading interest in cast iron pipe has made a request for prices. All of the surroundings of the market are firm. There is no improvement in deliveries on southern iron. Prompt shipment higher grade iron is firmer for southern brands. Spot southern iron is herewith quoted delivered at Cincinnati as a basis for settling contracts based on our quotations:

| | |
|---|---|
| Southern foundry No. 1 | $26.50 to 27.50 |
| Southern foundry No. 2, | 26.00 to 27.00 |
| Southern foundry No. 3, | 25.00 to 25.50 |
| Southern foundry No. 4, | 24.00 to 24.50 |
| Southern fdry. No. 1 soft, | 26.50 to 27.50 |
| Southern fdry. No. 2 soft, | 26.00 to 27.00 |
| Gray forge | 23.00 to 23.50 |
| Northern foundry No. 1, | 26.65 to 27.75 |

Northern foundry No. 2, 26.15 to 27.15
Northern foundry No. 3. 25.65 to 26.65
Jackson County silvery, 8 per cent ..... 31.15

Northern iron for prompt shipment is quoted at $25.00 at furnace first quarter $24.00, second quarter $23.00, and last half $21.50 to $22.00. There is so little northern available in the first half of the year that prices are largely nominal.

Southern iron is quotable at $23.00 to $24.00 Birmingham, for prompt shipment, $22.50 to $23.00 for first quarter, $21.00 to $22.00 for second quarter, and $18.50 to $19.00 for last half delivery, Birmingham basis. For the last half of the year the market seems to be nearing a $19.00 price, as the quotation of $18.50 is less frequent and there are more sales made on the $19.00 basis each week.

Southern charcoal iron is now $27.00 Birmingham. We quote for second quarter delivery, delivered Cincinnati, as follows:

| | |
|---|---|
| Southern Foundry No. 1 | $24.50 to 25.50 |
| Southern Foundry No. 2 | 24.00 to 25.00 |
| Southern Foundry No. 3 | 23.50 to 24.00 |
| Southern Foundry No. 4 | 23.00 to 23.50 |
| Southern Foundry No. 1, soft | 24.50 to 25.50 |
| Southern Foundry No. 2, soft | 24.00 to 25.50 |
| Gray Forge | 22.00 to 22.50 |
| Northern Foundry No. 1 | 24.65 to 25.15 |
| Northern Foundry No. 2 | 24.15 to 24.65 |
| Northern Foundry No. 3 | 23.65 to 24.15 |
| Jackson County Silvery, 8 per cent | 28.15 to 29.15 |

**Coke.**—The market remains firm. Buying is mostly for prompt shipment, but there are still a few contracts being placed for the first half of the year at the strong prices now quoted. There has been some improvement in the car supply and deliveries while still far in arrears, show some betterment. Prices in the leading coke producing districts are as follows:

| | |
|---|---|
| Wise County, Va. Furnace Coke prompt shipment | $3.25 to 3.50 per ton |
| Wise County, Va. Foundry Coke | 4.00 to 4.50 per ton |
| Pocahontas Furnace Coke prompt shipment | 3.25 to 3.50 per ton |
| Pocahontas Foundry Coke | 3.50 to 4.00 per ton |
| Connellsville Furnace Coke prompt shipment | 3.25 to 3.50 per ton |
| Connellsville Foundry Coke | 4.15 to 4.50 per ton |
| New River Foundry Coke on contracts | 3.50 to 4.00 per ton |
| New River Furnace Coke, prompt shipment | 2.75 to 3.00 per ton |

†Wise County, Va., Coke on Furnace contracts is sold mainly on a sliding scale basis for pig iron prices on the following basis: $1.50 to $1.75 per ton on $9.00 pig iron, plus 19 to 20 per cent of the advance on pig iron above $9.00 Birmingham.

**Finished Material.**—The demand continues good from store in a retail way. There have been sales of bar iron for first half delivery by some of the large interests at full prices. Retail prices for filling orders here are as follows:

Angles 3 x 3 and over, 2.15c to 2.25c; beams and channels 15 inches and under, 2.15c; small angles and architectural channels, 2.10c base; plates ¼ inch and heavier, 2c; 3-16 inch, 2.10c; No. 8, 2.10c; sheets (blue annealed) No. 10, 2.15c; No. 12, 2.20c; No. 14, 2.25c; No. 16, 2.35c; box annealed sheets Nos. 18 and 20, 2.50c; Nos. 22 and 24, 2.60c; Nos. 25 and 26, 2.65c; No. 27, 2.70c, and No. 28, 2.80c. Iron and steel bars, 1.95c base; boiler tubes, 6 per cent off base; turn buckle 45 per cent off; rivets, 3.15c base; cold rolled shafting 45 per cent off list; steel tire, 2.10c base.

**Old Material.**—While the market is easier and less active, dealers are not inclined to shade prices materially. We quote f. o. b. Cincinnati:

| | |
|---|---|
| Old No. 1 railroad wrought, net tons | $18.50 to 19.00 |
| Cast machine and foundry, net tons | 18.50 to 19.00 |
| Old iron rails, gross tons | 26.00 to 27.00 |
| Old steel rails, gross tons | 19.00 to 20.00 |
| Old short lengths, gross tons | 19.00 to 19.50 |
| Old iron axles, net tons | 26.00 to 27.00 |
| Heavy melting scrap, gross ton | 20.00 to 21.00 |
| Stove plate, net tons | 14.00 to 14.50 |
| Wrought turnings, net tons | 12.00 to 12.50 |
| Cast borings, net tons | 9.00 to 9.50 |
| Car wheels, gross tons | 20.50 to 21.00 |

## NEW YORK.

### Iron Market More Quiet, Though Good Sales are Made.

Office of THE IRON TRADE REVIEW. }
ROOM 1315, No. 150 NASSAU ST., Jan 8. }

**Pig Iron.**—The activity in pig iron during December has been succeeded by a week of relative quiet, and a somewhat easier feeling has been developed within the last few days. There have been moderate transactions in foundry, forge and basic iron, but no large single contracts have been closed for the second half of the year, yet fully 25,000 tons have been sold since Jan. 1. The purchases of from 7,000 to 8,000 tons of foundry grades by the International Steam Pump Co., for delivery at its various plants east and west has demonstrated the fact that considerable iron is still available for shipment during the first and second quarters of the year, and it is also claimed that concessions from previously current prices, for nearby delivery, were granted. The orders were divided among Virginia, Alabama and northern furnaces. The principal buying within the last few days, however, has been more of forge and basic than of foundry grades, and most of the forge iron has been for delivery during the first and second quarters of the year, although one lot of 5,000 tons was sold by a Lehigh valley furnace on the basis of $22 at the furnace, for delivery after the first of July.

There are several buyers of basic iron still in the market for delivery during the first and second quarters of the year, and it is significant that 1,000-ton lots have been secured at about $25, delivered, while in December high prices were paid. There are one or two round lots under negotiation for third and fourth quarter delivery, and contracts for 10,000 to 15,000 tons have been closed since the first of the year—the closing of negotiations begun in December.

The largest distributive agents believe that buyers will be disappointed in obtaining ample deliveries on contracts and hence will come into the market for a larger tonnage about the middle of the month.

It is well to remember that about 75 per cent of the foundry furnace capacity for the first half of the year has been placed under contract in the east, and that the increased cost of production will tend to check any sharp reaction in the market.

Among the sales since the new year began, not included in the above, have been 1,200 tons forge and 6,000 to 7,000 tons of foundry grades in lots, but none of them have been of special significance.

Foreign iron has been quiet and less strong although prices have not changed essentially. Spot Scotch iron brings $24.50 and $25 with sales of 100 ton lots. The following are prices at tidewater:

| | |
|---|---|
| Northern Foundry No. 1 | $24.00 to 26.00 |
| No. 2 Foundry | 23.50 to 25.50 |
| No. 2 Plain | 23.00 to 25.00 |
| No. 1 Southern Foundry | 23.50 to 26.00 |
| No. 2 Southern Foundry | 23.00 to 25.50 |
| No. 3 Southern Foundry | 22.00 to 24.00 |
| No. 4 Southern Foundry | 21.50 to 23.00 |

**Finished Products.**—Among finished steel products, structural and fabricated steel has been prominent since the first of the year. Several important contracts have been closed, and it is significant that the tonnage since the first of the year has come from commercial and industrial enterprises rather than from railroads. In New York city alone there are orders pending for numerous small buildings, calling for from 200 to 2,000 tons each of fabricated steel aggregating about 20,000 tons. Among the more important is a building on Fifth avenue requiring 2,000 tons and another requiring 3,000 tons. The principal local contract that has been closed has been for 8,000 tons, required in the construction of the tower to the Metropolitan Life Insurance Co. building on the block bounded by 23rd and 24th streets and Fourth and Madison avenues. The tower structure is 70 x 90 feet and forty-eight stories. The general contract went to Post & McCord and the fabrication will be done by the American Bridge Co.

The American Bridge Co. has received contracts for two more buildings to be erected at San Francisco, one requiring 800 tons and another 400 tons, making seven orders in all since the first of the year from the Pacific coast requiring 6,750 tons of steel. Contracts for two other buildings are

pending for San Francisco; one, requiring 1,000 tons of steel.

The official report of the volume of business transacted by the American Bridge Co., is now available, showing orders for 660,000 tons placed during the year 1906. The December tonnage aggregated 55,000 tons, being, next to October, the heaviest month of the year, when orders aggregated 58,000 tons. The American Bridge Co. now has an annual capacity of 700,000 tons of fabricated steel although the total for 1906 was only 600,000 tons. The extensions to the Elmira plant will give an additional monthly capacity of 10,000 tons, but the increase will not be available before the middle of the year, hence it is estimated that the 1907 shop capacity will be 750,000 tons.

**Old Material.**—An easier tone has been developed with contracts for 10,000 to 15,000 tons heavy steel melting scrap placed for January, February and March delivery in the eastern Pennsylvania district.

## PHILADELPHIA.

### Heavy Buying of Foreign Ore.—Some Hesitancy of Pig Iron Consumers.

January 8.

**Pig Iron.**—The market may be described as perhaps a little quieter in tone, but no less firm, than it has been for weeks. Basic indeed is stronger on some fair-sized orders, and as much as $24 at the furnaces has been paid for second and third quarter deliveries. While there is still an urgent demand for spot iron, especially from small consumers, who are willing to pay liberal premiums for it, there is among many buyers a disposition to hold off on orders for the last half until the trend of events shapes up a little more clearly. If there is no unexpected adverse development during the next two or three months, the orders of these purchasers for the third and fourth quarters may be expected to maintain, if not advance, the prices now ruling. An interesting feature of the present situation, to which little attention has been paid, is the large amount of foreign ore that is being bought for consumption along the Atlantic seaboard. The Bethlehem Steel Co. has for years imported Cuban ore, but other companies and dealers are buying large amounts of Spanish, Swedish, Russian and New Foundland ore, already aggregating at least 200,000 tons, for shipment this year. This is done largely because of the fear that Lake Superior shippers of ore will cut down on orders, as they have already intimated that they may be compelled to do. There is also a disposition to make a greater use of local ores, such as those in the Lake Champlain district, northern New Jersey and Pennsylvania, because of the rapidly increasing price of the Lake Superior product and difficulty in securing it. Weekly cargoes of English and Scotch irons continue to arrive, and have been sufficient to check any advance in that line. There have been some pressing demands for low-phosphorus iron, always scarce, which have led to its price being marked up, and basic, as has been said, is eagerly sought by large steel-making plants. Foundry irons continue unchanged in prices, and quotations may be given as follows for the last half:

| | |
|---|---|
| No. 1X Foundry | $26.00 to 26.75 |
| No. 2X Foundry | 23.75 to 24.75 |
| No. 2 Plain | 23.25 to 23.75 |
| Standard Gray Forge | 22.00 to 22.50 |
| Basic | 23.75 to 24.50 |
| Low Phosphorus | 27.25 to 28.00 |

**New Material.**—There is a lively demand for nearly all forms of finished material, plates and structural material being especially active. The momentary lull due to the holidays seems to have passed entirely away, and the market is moving along with its accustomed strength. Premiums are asked for in some lines for anything like reasonably prompt delivery. Prices may be quoted as follows:

Beams, channels and angles according to specifications, 1.83½c to 2c; refined iron bars, 1.89½c to 1.93½c; steel bars, 1.83½c to 1.88½c; plates, 2.03½c to 2.08½c.

**Old Materials.**—There has been no feature of note during the past week. The very open winter, which favors the collection of scrap by small dealers and thus adds to the available stocks, is having its effect in preventing prices from keeping pace with the advances in pig iron. Prices may be quoted unchanged as follows:

| | |
|---|---|
| Old steel rails | $20.00 to 20.50 |
| No. 1 steel scrap | 19.75 to 20.25 |
| Old steel axles | 23.50 to 24.00 |
| Old iron axles | 31.00 to 32.00 |
| Old iron rails | 27.00 to 28.00 |
| Old car wheels | 22.00 to 23.00 |
| Choice scrap, R. R. No. 1 wrought | 23.00 to 23.50 |
| No. 1 yard scrap | 20.00 to 20.50 |
| Machinery scrap | 20.50 to 21.00 |
| Low phosphorus scrap | 23.50 to 24.00 |
| Wrought iron pipe | 17.25 to 17.75 |
| No. 1 forge fire scrap | 17.00 to 17.50 |
| No. 2 forge fire scrap, ordinay | 12.50 to 13.00 |
| Wrought turnings | 16.50 to 17.00 |
| Axle turnings, heavy | 17.00 to 17.50 |
| Cast borings | 13.50 to 14.00 |
| Stove Plates | 16.75 to 17.25 |

## ST. LOUIS.

### Increased Interest in Iron For Future Delivery.—Prices are Firm.

January 7.

**Pig Iron.**—After the customary holiday quiet, the market has opened with a brisk movement for the new year and some rather good tonnages are being booked. No doubt the most distinct improvement to be noted in the market is the shifting of interest from spot to future delivery. While the orders for immediate shipment are being booked in good volume, the melters are turning their attention more freely to third quarter and last half. This indicates confidence in the future and a belief in the stability of present prices, which is encouraging to the furnaces.

There were more inquiries in the mail today and Saturday than there were for the two weeks preceding. Most of these are for the last portion of the year. There appears to be less haggling over prices, too, than might be expected for so long in advance. Evidently melters have come to the realization that prices are not so ficticious as they wanted to believe and that despite the rather large accumulation in southern yards, due to the car shortage, prices will hold. If there is an accumulation of 50,000 tons at Birmingham it is all contracted for and the indications point to a consumption equal to production under the most favorable conditions.

Iron for immediate delivery is quoted at $23.50 for No. 2 Birmingham; second quarter, $19.50 and last half, $18.50. Among the best sales of the week were 3,000 tons of Bessemer. 3,000 tons of malleable and 1,000 tons of southern No. 2 to the American Car & Foundry Co.; 1,000 tons of No. 2 soft to a St. Louis melter; 1,000 tons of basic to another house and 500 tons of basic to a melter in St. Louis territory.

The Tennessee-Republic interests are sold up and are out of the market to July 1.

Iron quotations, including the freight rate of $3.50 from Birmingham, range as follows for the first quarter. (No attention will be paid to the advance in the freight rate until it takes effect Feb. 1.)

| | |
|---|---|
| Southern No. 1 | $26.50 to 27.00 |
| Southern No. 2 | 26.00 to 26.50 |
| Southern No. 3 | 25.50 to 26.00 |
| Southern No. 4 | 25.00 to 25.50 |
| Gray Forge | 24.50 to 25.00 |

**Coke.**—Improved buying was noted in the last few days and several good round tonnages were ordered on a basis of $4.25 for Connellsville foundry coke.

**Finished Material.**—St. Louis houses are not so far behind on orders for steel plates, bars, channels, spikes and bolts as they were, but a fair volume of business is being done. Activity is noted in the building lines and several large contracts are in view. Christo-

pher & Simpson got the contract for the steel, 200 tons, for the Seventeenth Street Realty building and the Union Iron Works booked the order for the steel, 100 tons, for an office building at Shawnee, Okla. Specifications for the 19-story LaSalle building, requiring 1,200 tons of steel, have been withdrawn for revision. Among the projects exciting interest today are the Lauran building, the addition to the new Augusta building, the addition to the National Bank of Commerce and the American hotel and theater.

## BUFFALO.

### Pig Iron Market Quiet But Firm.—Furnaces Working Well.

January 7.

**Pig Iron.**—Business since the beginning of the new year has been quiet and the past week was not marked by variations in prices. Iron remains firm, but there are indications that prices will change soon should the demand for pig iron continue strong for third and fourth quarters. The statement is made here that all prompt delivery iron for first half is out of the market. A number of the oldest customers of local furnaces are bearing down hard on the furnace operators to get them a carload or two more than their contracts call for, but these firms generally have had to be turned down. A great deal of caution is now being exercised in the sale of foreign iron for spot delivery. No large contracts have been made the past few days, nothing being placed where there is any uncertainty of delivery. These indications of famine in the foreign supply cause some alarm, as it is understood that the reason for the cautious methods used is the fact that vessels cannot easily be chartered for future business.

An encouraging feature of the market is the report that local furnaces are working better than in many months. In two instances furnaces have each produced from 1,000 to 2,000 tons more during December than they had for several months previous. While this excess offers some relief, it is but small compared with the demand. There seems to be no doubt but that it will be a good many months before the supply and demand in this district reach a balance. Consumers, however, are buying carefully, looking out for the future by placing contracts which will safely cover all likely needs. The buying for last half delivery is more general here and much of the output of local furnaces for the last half has been placed. It is variously estimated that from 50 to 75 per cent of the probable output has been placed, but it is safe to figure that 50 per cent at least has been bought. There is a good deal of business being done for the last quarter and if business runs along as it is now the third quarter will soon be out of the market. For last half delivery we quote as follows:

| | |
|---|---|
| No. 2 Plain Foundry | $22.00 to 23.00 |
| No. X Foundry | 22.50 to 23.00 |
| No. 3 Foundry | 22.00 to 23.50 |
| Malleable Bessemer | 23.00 to 23.50 |
| Gray Forge | 21.50 to 22.00 |
| Charcoal | 25.00 to 26.00 |

# Metal Market

## NEW YORK.

January 8.

**Copper.**—The prominent feature in refined copper, within the last few days, has been the placing of large contracts by American consumers for electrolytic copper for May shipment, at 24c delivered 30 days, the United Metals Selling Co. having come into the market immediately upon the opening of the new year, after having retired in December. While the Amalgamated interests are understood to have taken the bulk of the recent contracts, independent producers have shared to a considerable extent. There also have been small sales of electrolytic for January and February shipment at 24¾c to 25c delivered 30 days, and small lots of lake for immediate shipment also have brought 25c, but it should be remembered that scarcely more than 1 per cent of the entire American production of about 436,000 tons annually, is sold for spot or nearby delivery. The great bulk of the business is done for delivery within 60 to 90 days, and recent heavy transactions have been made for delivery within four and five months. Casting grades have sympathized with lake and electrolytic and now command from 23½c to 24c, the outside price for immediate shipment.

In Europe there has been less activity in refined metal, the sharp drop and wide fluctuations in standard warrants at London checking confidence abroad temporarily. There has been a full recovery, however, and since the first of the year, the market has advanced from 10s. to £3 2s. 6d. from the lowest point.

Since the first of January exports of copper from Atlantic ports have aggregated 3,272 tons. During December the total exports from Atlantic ports were only 14,023 tons, but with the shipments from southern and Pacific ports the total was probably but little under 15,000 tons; next to September, the smallest monthly exports during 1906.

**Tin.**—Pig tin has been subject to wide and violent fluctuations in the foreign markets since the first of the year with a net deline of £3 to £4, after a recovery of from £2 to £2½ on January 7. American consumers took advantage of the lower prices to purchase heavily of spot, January and February and early March delivery. It is estimated that American purchases have been 800 tons, prices ranging down from 42½ to 41.05. At the close there was a recovery of ½ to ¾ of a cent per pound, spot metal commanding 41.70c, while tin ex-steamships afloat is held within 10 points of this price.

## ST. LOUIS.

January 7.

Lead was quiet at $6.02 to $6.05 today for Missouri, with non-corroding brands selling at $6.10. Spelter was dull at $6.62½.

The initial shipment of zinc ore in the Missouri-Kansas field of the year 1907 is 40 per cent greater than last year, and that of lead 30 per cent greater than for the first week of last year. With the reserve stock 100 per cent larger, to draw from in case of suspension on account of bad weather, and prices apparently firmly intrenched, the year starts auspiciously for the producers.

## TIN PLATE MANUFACTURE

### In Canada Soon to be Begun at Morrisburg, Ont.—Canadian Notes.

Toronto, Can., Jan. 7.—The works of the Canada Tin Plate & Sheet Steel Co. at Morrisburg, Ont., now nearly completed, will be opened about Jan. 23 or 24. As this is the introduction of the tin plate industry into Canada, the directors have decided to make it the occasion of a public demonstration, with appropriate speeches and festivities. In view of the emphatic declarations that the industry could not possibly flourish, without the aid of protective duties, for which the new tariff experiment will be watched with much interest.

The Dominion Iron & Steel Co., Sydney, N. S., as a result of its difficulties with the Dominion Coal Co. over its coal supply, has determined to own and work its own coal mines. A deal has just been closed between the company and Thomas Routledge and others, owners of extensive coal measures in Nova Scotia, lying near the Dominion Steel Co.'s works, by which the company has secured coal areas estimated to contain several hundred million tons of coal. The steel company will begin development work at once and will also erect shipping piers and export their surplus output.

# THE IRON TRADE REVIEW

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## AN INCREASE IN EXPORTS.

The beginning of the year is naturally a time for casting up accounts to see where we stand. The government statistics of imports and exports in the last calendar year will not become available for about a month, the November figures having just been presented, and it appears preferable to make an estimate for the month of December, so that a fairly accurate picture of the iron and steel movement can be presented at this time. The November figures show about equally distributed increase and decrease in exports as compared with October, so that it will probably do no violence to assume that December exports have been at the average rate of October and November. The month of November showed increases in scrap, pig iron, wire rods, steel bars, rails, steel sheets and plates, tin plates and pipe and fittings, over October, while decreases were shown in the other items customarily enumerated. Assuming, then, that December exports in each line have been at the average of October and November, the year totals will compare as follows with the two previous years. It should be noted that sheets are included with plates, and that tonnage returns were not made for 1904 or 1905 in the case of pipe and fittings:

**Iron and Steel Exports, Gross Tons.**

| | 1904. | 1905. | 1906. |
|---|---|---|---|
| Scrap | 26,785 | 7,966 | 11,300 |
| Pig iron | 49,025 | 49,221 | 82,400 |
| Crude steel | 314,324 | 237,638 | 194,500 |
| Bar iron | 29,582 | 32,025 | 55,900 |
| Steel bars | 25,895 | 19,890 | 32,100 |
| Wire rods | 20,073 | 6,514 | 5,900 |
| Hoops, etc. | 3,435 | 4,426 | 4,900 |
| Rails | 414,845 | 295,023 | 320,200 |
| Iron plates | 4,727 | 8,004 | 17,800 |
| Steel plates | 50,477 | 67,093 | 96,900 |
| Tin plates | 7,898 | 7,941 | 11,900 |
| Structural | 55,514 | 83,193 | 110,000 |
| Wire | 118,612 | 142,609 | 178,100 |
| Cut nails | 9,273 | 7,890 | 7,700 |
| Wire nails | 32,793 | 35,836 | 47,200 |
| Other nails | 3,047 | 4,021 | 5,500 |
| Pipe, etc. | ..... | ..... | 171,600 |
| Total | 1,167,710 | 1,009,290 | 1,353,900 |

The total for 1906 is larger than it should be, compared with the two preceding years, on account of the introduction of pipe. The returns by value show that there has been a moderate increase in this item, and making allowance for it would leave a total of about 1,200,000 gross tons, to be compared with 1,167,710 tons in 1904 and 1,009,290 tons in 1905.

Thus it is to be observed that our iron and steel exports have increased, from 1905 to 1906, by about 200,000 tons, or almost 20 per cent. Conditions in the domestic market would not have led one to expect this. While it is true that the domestic industry was quite prosperous in 1905, it was still more prosperous in 1906, and all classes of material were scarcer. The largeness of the exports in 1905, considering domestic conditions, might have been attributed to the filling of contracts made in 1904, when the complexion of affairs was different, but the exports in 1906 obviously must have depended upon contracts made when the home market was, according to all accounts, clamoring for material.

The theory has always been that iron and steel exports are a sign of adversity; that they are made chiefly because the domestic market is unable to absorb all the material which the mills could produce when running at full pressure. There have been a number of instances in the past few years of the outcome running contrary to the theory, and the figures for 1906 furnish another instance of this. The exports in 1906, the most prosperous year the American iron trade has ever seen, have measurably exceeded the exports in 1904, which was distinctly an off year in demand and production, and have broken all other records besides.

The increase, moreover, is thoroughly distributed over the whole list, with but one or two exceptions. The only clear exception is crude steel, including ingots, blooms, billets, slabs and sheet bars. This item decreased from 314,324 tons in 1904 to 237,638 tons in 1905 and 194,500 tons in 1906. While the decrease is fairly large in tons, the 1906 total is still large, enough to supply all the independent tin mills in the United States, and leave some tonnage for the independent sheet mills. Rail exports in 1906 were less than in 1904, but nearly 10 per cent larger than in 1905.

The item of wire rods appears to show a decrease, but wire and wire nails show large increases, far more than covering the decrease in wire-rods. The totals of wire rods, wire and wire nails, have been as follows: 1904, 171,478; 1905, 184,959; 1906, 231,200.

The most important increases have been in plates and shapes, which have practically doubled from 1904 to 1906.

The argument is frequently made that the American iron trade need no longer fear industrial depression, because it has reached a position where, in times of depression, it can export heavily. Even as a theory this is hardly attractive, when it is noted that in the most prosperous year the trade has ever seen the exports have broken all records. What is left for the time of depression? Then, again, no serious depression strikes the American iron trade except when the markets of the world are also depressed. England is just now congratulating herself on having exported about 4,760,000 gross tons of iron and steel products in 1906, which is a record by fully 600,000 tons. Germany is in the same position, with a somewhat smaller total. Both these countries have had during the past year a most satisfactory domestic market. Their exports have been very profitable, and

have been at prices little if any below the prices charged in their domestic markets. It is not within reason to suppose that in the event of a general depression, causing a decreased demand in the world's markets, these two countries will stand idly by and allow the United States to increase exports, when there is a less volume of business to go around than formerly. It is an open question whether, in a real test, the United States can undersell England and Germany in neutral markets. This country has occasionally been able to make great price sacrifices in order to secure export business, but the sacrifices have been from current domestic rates, and the reduced prices are not necessarily so different from those which the British and German producers regard as not unsatisfactory.

Imports showed no important movement in 1906, compared with previous years, except in the case of pig iron, in which it is well known there has been a special import movement. These imports, however, are but barely discernible in the statistics to Dec. 1. The monthly imports have been as follows.

January, 25,657; February, 14,972; March, 32,282; April, 22,885; May, 28,848; June, 22,906; July, 37,509; August, 18,843; September, 26,711; October, 35,789; November, 39,751; total, 11 months, 305,416.

The total given is that of the government, the actual summation of the monthly figures differing by a few hundred tons, the discrepancy being due to errors in the government returns which are corrected in the total. These imports include ferro-manganese and spiegeleisen, as well as special irons. The total of the first six months is about 147,500 tons, but this includes 25,842 tons of ferro-manganese and 53,834 tons of spiegeleisen, leaving but 57,900 tons of pig iron proper. The monthly average of all, during the first half, is 24,592 tons, the average in the following five months being 31,573 tons, so that an increase of only 7,000 tons per month is shown. It may be that the imports of the manganese metals have decreased and that imports of regular pig iron have increased more than would be indicated, but in any event the imports of pig iron were not large to the end of November. The statistics relating to the manganese metals are only available some time after the expiration of the quarter.

## ADHERING TO CONTRACTS.

In the review of the iron and steel markets in the east during the year 1906, published in our columns last week, the following paragraph appeared:

In New England, foundry iron producers of New York state had been selling heavily throughout the summer at prices which practically shut southern furnaces out of the market. In the early fall it became apparent that transportation facilities would not be equal to the demand occasioned by the great volume of crops to be moved and the unusual activity in all industries, and freight difficulties began to appear. When the New England foundrymen received only 10 to 15 per cent of shipments promised by the New York state furnaces, there was an inevitable rush to cover. Prices for spot iron rose enormously and the end is not yet.

A pig iron manufacturer in New York, noted for his integrity and strict adherence to contracts writes us calling attention to the above paragraph, and says:

"A sweeping statement of this sort includes all of us who are making pig iron in New York state and, therefore, to the person who is religiously living up to his contracts, resisting the temptation to sell, for prompt delivery, twenty-five-dollar iron, when he is making deliveries on old contracts at $17, it becomes an injustice which hurts, particularly considering the high authority of the statement. We cannot answer for others and there may be those furnaces in New York state which are forwarding only 10 to 15 per cent of shipments, but it is not true of the plants which we control. Our furnaces have at no time oversold their expected production and except for a period when summer weather conditions reduced their normal output, they would not have been at any time behind contract date of deliveries even to a small percentage, and yet during the period just affected, they were able by adjusting deliveries between those who were in need and those who were not in haste to take care of all orders in such a manner that no customer suffered from delay in shipments."

In the iron markets, as well as in many other affairs of life, reprehensible practices are more frequently heard of than are the honorable acts. We do not entertain a shadow of a doubt that there are many furnace operators today who with scrupulous honesty are adhering to their contracts, and nothing is said about it, while the occasional violation of the spirit, if not the letter, of a contract is the cause of much complaint. It was plainly the intention of our New York correspondent to show that the railroads were to blame for the failure to deliver iron to New England foundries. It certainly was not our intention to reflect in any way on any furnace owner who is faithfully doing as he promised to do.

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The statement made by THE IRON TRADE REVIEW last week that two large eastern Pennsylvania rail manufacturers had announced that they were taking no more orders for standard sections for delivery after August except at $30 per ton, the highest price asked for Bessemer rails since 1900, has aroused much interest and in some quarters its correctness has been questioned, but we have the highest authority for the statement that the information is entirely accurate. It is also true that the Bethlehem Steel Corporation secured $32 a ton for 22,500 tons of open-hearth steel rails sold to the Harriman lines for delivery in the latter half of the present year. Judge Gary, of the United States Steel Corporation, when interviewed, stated that he did not believe that the corporation would advance its present quotation, $28. There is naturally a difference of opinion as to the wisdom of the advances made by independent companies which feel that they are fully justified in their action by the tremendous demand. Some manufacturers do not hesitate to say that they think $28 is high enough and express doubt as to whether many rails will be sold at a higher quotation. Time alone will demonstrate who is correct. It is significant, however, that the steam railroads are not buying heavily at present, even at the old quotation.

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Dan V. Doran, for twenty years associated with Matthew Addy & Co., at St. Louis, died of catarrh of the stomach Jan. 7. Beginning as an office boy he worked himself up to an interest in the company and was one of the most popular salesmen in the territory. He was known from Cincinnati to Kansas City and from Chicago to Birmingham. He was 34 years old and married.

# NEW RECORD IN ORE RECEIPTS AT LAKE ERIE PORTS.

The figures compiled by the *Marine Review* from the returns sent in by the various dock companies show that iron ore receipts at Lake Erie ports during the season of 1906 were 32,076,757 tons, out of a total movement of ore by lake of 37,513,595 tons. Lake Erie docks on Dec. 1 held a balance of 6,252,455 tons. During 1905 the total output shipped by lake was 33,476,904 tons, of which Lake Erie docks received 28,941,259 tons and held a balance on Dec. 1, 1905, of 6,438,967 tons. During 1904 the total by lake was 21,226,591 tons, of which Lake Erie docks received 17,932,814 tons and held a balance on Dec. 1 of 5,763,399 tons. The reserve of 6,252,455 tons on Lake Erie dock Dec. 1 is ample for winter consumption. Never in the history of the trade has 5,000,000 tons gone forward from dock to furnace during the winter season, and moreover, furnace stock piles are abundant.

As compared with last year the receipts at Lake Erie ports show an increase corresponding closely to the increase in total shipments for 1906 over 1905. In the matter of tonnage received the three leading ports retained their relative positions of 1905 ranking Ashtabula, Cleveland and Conneaut. Cleveland, however, made a gain reducing the lead of 519,034 tons which Ashtabula held in 1905 to 228,691 tons this year. Conneaut, on the other hand, fell back relatively to both of the leading ports. Since 1903 the order of precedence has undergone a complete cycle of changes. In 1903, it was Cleveland, Ashtabula, Conneaut, in 1905 and 1906, Ashtabula, Cleveland, Conneaut.

Shipments to furnaces between May 1 and Dec. 1, 1906, aggregate 27,615,392 tons, compared with 24,311,720 tons in 1905, compared with 16,658,806 in 1904, with 16,903,013 tons in 1903, with 18,423,364 tons in 1902, and with 14,204,596 tons in 1901.

The shipments to furnaces during the season of navigation as referred to are determined in this way: First we have the amount of ore on Lake Docks before the opening of navigation, May 1 last, 1,791,090 tons; add to this the receipts of the season just closed, 32,076,757 tons, and the total is 33,867,847 tons; deduct the amount on dock Dec. 1, 6,252,455 tons, and we have 27,615,392 tons as the amount that was forwarded either direct or from dock to furnace yards. It is, of course, understood that the difference between the total output of 37,513,595 tons, which was shipped from the Lake Superior mines during 1906, and the receipts of 32,076,757 tons at Lake Erie ports, is ore that went to places other than Lake Erie ports, such as the furnaces at Detroit and South Chicago. The above table shows receipts at Lake Erie ports and amounts on dock during six years past.

IRON ORE RECEIPTS AT LAKE ERIE PORTS, GROSS TONS.

| Ports | 1906 | 1905 | 1904 | 1903 | 1902 | 1901 |
|---|---|---|---|---|---|---|
| Toledo | 1,423,741 | 1,006,855 | 508,793 | 652,305 | 1,037,571 | 798,298 |
| Sandusky | 35,847 | 51,202 | 48,356 | 130,532 | 165,556 | 33,017 |
| Huron | 778,453 | 825,278 | 231,364 | 486,106 | 520,646 | 431,311 |
| Lorain | 2,191,965 | 1,605,823 | 972,931 | 990,490 | 1,442,417 | 721,662 |
| Cleveland | 6,604,661 | 5,854,745 | 3,572,228 | 4,434,160 | 4,873,318 | 3,831,060 |
| Fairport | 1,861,498 | 2,008,621 | 1,157,858 | 1,434,342 | 1,538,744 | 1,181,776 |
| Ashtabula | 6,833,352 | 6,373,779 | 3,639,250 | 4,242,160 | 4,796,805 | 3,981,170 |
| Conneaut | 5,432,370 | 5,327,552 | 4,083,655 | 3,903,937 | 4,300,301 | 3,181,019 |
| Erie | 1,986,539 | 2,112,476 | 1,284,778 | 1,257,798 | 1,717,268 | 1,379,377 |
| Buffalo & Tonawanda | 4,928,331 | 3,774,928 | 2,433,601 | 2,194,901 | 2,256,798 | 1,475,386 |
| Total | 32,076,757 | 28,941,259 | 17,932,814 | 19,681,731 | 22,649,424 | 17,014,076 |

IRON ORE ON LAKE ERIE DOCKS, DEC. 1, GROSS TONS.

| Ports | 1906 | 1905 | 1904 | 1903 | 1902 | 1901 |
|---|---|---|---|---|---|---|
| Toledo | 281,000 | 368,024 | 318,573 | 106,710 | 310,023 | 254,196 |
| Sandusky | 17,467 | 52,977 | 75,134 | 95,275 | 95,175 | 47,384 |
| Huron | 245,499 | 208,023 | 182,495 | 253,249 | 232,767 | 231,501 |
| Lorain | 336,321 | 271,695 | 299,504 | 288,581 | 328,304 | 195,863 |
| Cleveland | 1,224,606 | 1,330,619 | 1,237,033 | 1,337,750 | 1,500,604 | 1,378,060 |
| Fairport | 590,783 | 759,961 | 660,420 | 845,946 | 924,236 | 710,590 |
| Ashtabula | 1,631,312 | 1,589,951 | 1,403,575 | 1,911,911 | 1,967,136 | 1,769,145 |
| Conneaut | 1,057,424 | 976,976 | 684,487 | 591,364 | 673,679 | 604,106 |
| Erie | 552,631 | 564,961 | 583,439 | 657,409 | 722,966 | 470,718 |
| Buffalo | 315,412 | 315,780 | 318,739 | 282,890 | 319,367 | 198,100 |
| Total | 6,252,455 | 6,438,967 | 5,763,399 | 6,371,085 | 7,074,254 | 5,859,663 |

The shipments of iron ore by water from the Lake Superior region for 1906 were 37,513,595 tons. The following table shows the shipments for five years:

| | 1906 | 1905 | 1904 | 1903 | 1902 | 1901 |
|---|---|---|---|---|---|---|
| Escanaba | 5,851,050 | 5,307,938 | 3,644,267 | 4,277,561 | 5,413,704 | 4,022,668 |
| Marquette | 2,791,033 | 2,977,828 | 1,907,301 | 2,007,346 | 2,595,010 | 2,354,284 |
| Ashland | 3,388,106 | 3,485,344 | 2,288,400 | 2,823,119 | 3,553,919 | 2,886,252 |
| Two Harbors | 8,180,125 | 7,779,850 | 4,566,542 | 5,120,656 | 5,605,185 | 5,018,197 |
| Gladstone | ..... | 5,118,385 | 4,169,990 | 3,978,579 | 4,180,568 | 2,321,077 |
| Superior | 6,083,052 | ..... | 553 | 35,816 | 92,375 | 117,089 |
| Duluth | 11,220,218 | 8,807,559 | 4,649,611 | 5,356,473 | 5,598,408 | 3,437,955 |
| Total by lake | 37,513,595 | 33,476,904 | 21,226,664 | 23,649,550 | 27,039,169 | 20,157,522 |
| Total by rail | ..... | 876,552 | 596,175 | 640,328 | 531,952 | 436,015 |
| Total shipments | ..... | 34,353,456 | 21,822,839 | 24,289,878 | 27,571,121 | 20,593,537 |

The table does not include shipments to Lake Erie ports from the Lake Superior Corporation's Helen mine in Canada on the Michipicoten range.

## PHILADELPHIA FOUNDRYMEN ELECT.

The sixteenth annual meeting of the Philadelphia Founrymen's Association was held at the Manufacturers' Club in that city on the evening of Jan. 2, when the officers nominated at the previous meeting were unanimously elected, with the exception that M. O. Steele and H. L. Haldeman were chosen to the places on the executive committee formerly held by H. O. Evans and R. C. Oliphant.

Speaking for the committee appointed to provide for the entertainment of the American Foundrymen's Association's convention in May, Dr. E. E. Brown reported that a meeting had been held, attended by representatives of the Foundry Foremen's Association at which good progress had been made. No definite program had been outlined, but the committee had reached a better understanding of the scope and character of the entertainment to be provided, and was in better shape to go ahead with the work. The prospects for the convention, he said, were excellent, and from 1,000 to 1,500 persons were expected to attend. Already applications have been received for greater space than the Second Regiment Armory contains for exhibits, and everything points to a most successful gathering, in which the exhibits will be a very important feature. The Hotel Majestic has been chosen as headquarters for the delegates, and a monster shad dinner will undoubtedly be one of the features of the entertainment planned.

The technical paper of the evening was presented by W. O. Steele, of the Bateman Mfg. Co., of Grenloch, N. J., on "Improved Attachment for the Wadsworth Core Machine," which has been described in the IRON TRADE REVIEW. E. J. Erling, dealer in foundry supplies, was elected to membership. Secretary Evans announces that an invitation had been received from the New England Foundrymen's Association to a dinner in Boston Jan. 9, and he urged that as many as possible attend. The meeting was followed by a buffet lunch at which short addresses were made by several of those pres-

## UNION OFFICIALS JAILED.

### Striking Molders at Milwaukee Punished for Violating Injunction.

Judge A. L. Sanborn, sitting in the federal court, at Milwaukee, Jan. 3, found eight members of Molders' union No. 125, guilty of contempt of court for violating an injunction obtained in behalf of the Allis-Chalmers Co. in connection with the strike of molders now in progress. He sentenced the six defendants to terms in the county jail for fifteen to forty days each. In one case further hearing will be had, and in another the defendant was not in court. Of the six sentenced, stay of execution was granted in all cases but one, pending the issuance of a writ of error, and appealing the cases to the Court of Appeals.

### Three Others Guilty.

In the cases of three men the judge found that there was cause for finding them guilty, but he suspended sentence. In the cases of three others the action was dismissed, the court finding that because of certain technicalities, it did not have jurisdiction. Business Agent Schwab was found not guilty, the court holding that his duties were of such a general nature that he did not appear to have charge of the pickets who committed violations. In the cases of those sentenced, bail was fixed at $100 each. These, however, are for appearance only. The prosecution holds that the decision is in full accord with its interpretation of the opinion handed down by the judge some weeks ago.

Of the eight molders sentenced by Judge Sanborn, four were found guilty of intimidating workmen, two, the captains of the pickets, of violating the injunction in their management of the men and the two others, the chairman and treasurer of the strike committee, of having in charge the pickets who intimidated the men.

### Striking Molders Return.

Twelve striking molders returned to work in the shop of J. A. & P. E. Dutcher Co., Jan. 2. These men are now working with the independent men, who have been in the shop since last May, and have returned otherwise under the identical conditions, as far as wages and hours are concerned, as they were when they went out, says the National Founders' Association. No agreement with the union officials has been signed by the company.

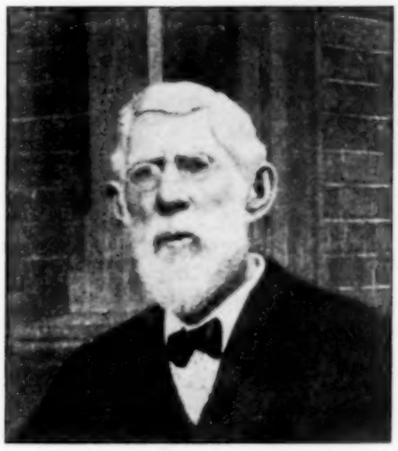
### Labor Notes.

The National Founders' Association reports that four of the highest grade molders in the employ of the Allis-Chalmers Co., at Scranton, Pa., prior to the strike, have given up their union affiliations and returned to work for that company, stating that they preferred to work on an independent basis hereafter.

At Buffalo, N. Y., five union molders have been expelled from the local union for joining the ranks of independent men and returning to work. It is stated by the National Founders' Association that this makes a total of 16 molders and coremakers who have given up the union and returned to work in that city.

## DEATH OF ABRAHAM R. LUDLOW.

Abraham R. Ludlow, a pioneer citizen and manufacturer of Springfield, O., died at his home in that city Jan. 2, at the age of 80 years. He was



Abraham R. Ludlow.

born in Springfield and spent his entire active life in that city. When a young man he entered the contracting business and later with several associates organized the firm of Ferrell, Ludlow & Rodgers, manufacturers of farm implements. Later this concern was merged in the American Seeding Machine Co. For many years he was the head of the Springfield Malleable Iron Co., but his failing health compelled him to retire from active duties about a year ago. Mr. Ludlow always took a great interest in the affairs of his home city, occupying public positions at various times. He was prominent in the old Murphy movement and temperance revival in 1873 and was the Prohibition candidate for governor of Ohio that year. Among the surviving children is Thurston W. Ludlow, secretary and superintendent of the Springfield Malleable Iron Co. The funeral was held at his late home, Jan. 4, and interment was made at Ferncliff cemetery, Springfield.

## OBITUARIES.

David Thompson, New York, died Dec. 30, at the age of 84. He was an iron importing merchant, and was the oldest graduate of Columbia

Robert Q. Bowers, senior member of the firm of R. Q. Bowers & Son, iron founders at Hackettstown, N. J., died in a hospital at Easton, Pa., where he had gone to undergo a surgical operation.

George Benjamin Nutt, aged 46, died Jan. 4 at his home in Pittsburg. He was identified with the iron and steel business of Pittsburg and at his death was the western representative of Pilling & Crane, of Philadelphia.

Robert H. Sayre, one of the pioneers of the Birmingham mineral district, died at his home in Bethlehem, Pa., Jan. 4. He was the organizer of the Pioneer Mining & Mfg. Co., and of the Sayre Mining & Manufacturing Co.

George W. Lauer, at one time an iron manufacturer in Jersey City and later one of the proprietors of the Robbins rolling mill of Philadelphia, died in that city, Dec. 27, at the age of 77. He is survived by a widow and one son.

Sylvester A. Cosgrave, aged 61, the inventor of an armor plate process, died Dec. 30, at his home in Pittsburg. His steel interests kept Mr. Cosgrave in New York, but he retained his family home in Pittsburg. A wife, four sons and one daughter survive him.

James H. Willock, one of Pittsburg's most active business men, died in that city Jan. 2 at the age of 53. He was a well known banker and was closely identified with numerous industrial enterprises of Pittsburg, including the Firth Sterling Steel Co.

William K. Naylor, owner of the shovel works at Corey, Pa., died at the home of his nephew in Sharon, Pa., Jan. 1. Mr. Naylor formerly resided at Sharon, and was connected at various times with the National Malleable, American Steel Foundries and other companies.

William G. Neilson, treasurer of the Keystone Drop Forge Works of Chester, Pa., and president and treasurer of the Republic Mining & Mfg. Co., a Georgia concern, died suddenly from heart disease in his office in the Harrison building, Philadelphia, Dec. 29, at the age of 64. He had been identified with the iron trade from his youth, and when a young man he was for a time connected with the American Iron and Steel Association. He is survived by a widow, four daughters and two sons.

## GREAT ACCUMULATION IN SOUTHERN FURNACE YARDS.

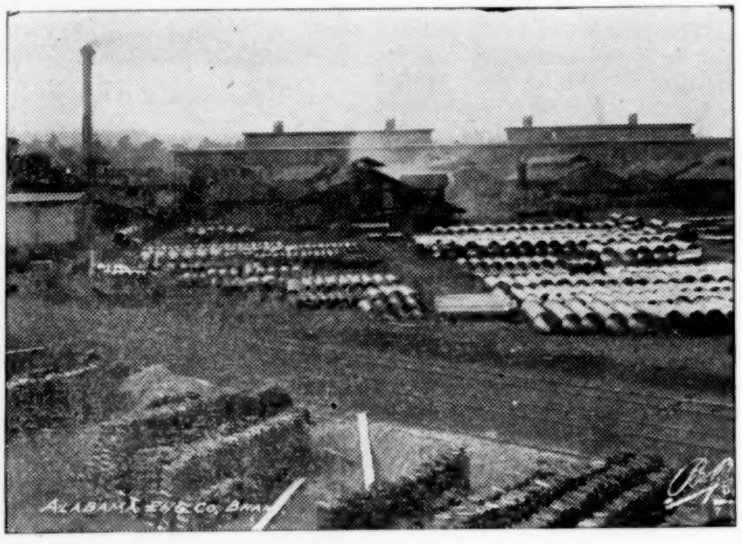
(Special Correspondence.)

Birmingham, Ala., Jan. 7.—Furnaces in this district entered the new year with heavy stocks of iron in their yards. In practically every instance this was the result of the inadequate transportation facilities which prevailed through the fall and early winter. The iron was sold and would-be consumers were clamoring for deliveries, but the railroads were so badly hampered by cars in ill-repair and by lack of ample motive power that the accumulations in furnace yards steadily increased. Some idea of the condition of iron and pipe yards may be gained from accompanying photographs.

Pig Iron Awaiting Shipment Near Birmingham, Ala.

One furnace was blown in during the past week, but two days later another iron-maker went out of operation for repairs. Both stacks are located at Bessemer and are the property of the Tennessee Coal, Iron & Railroad Co. Five furnaces in this state are nearing completion, after a thorough repairing they will be ready for the torch within the next few weeks and it is understood, will resume work at the earliest possible moment. The weather conditions have been favorable for all outside work and the production at the coal and ore mines, limestone quarries, around coke ovens and other out-door places has been improving steadily. There is need for all the raw material that can be produced.

Joseph Hoadley, the newly elected president of the Alabama Consolidated Coal & Iron Co., is on his first visit to the Birmingham district and is inspecting the properties of the company. According to an interview given out the first day of his arrival, there will be some extensive improvements made by the Alabama Consolidated, in addition to further development of properties, in the near future. A couple of million dollars at least will be expended in the betterments and developments. It is not believed there will be many, if any, changes in the operating management of the Alabama Consolidated Coal & Iron Co.



Large Accumulation of Pipe in Birmingham District.

The work of the new steel plant of the Tennessee Coal, Iron & Railroad Co. at Ensley will be rushed to completion this year. The contractors, so it is learned, will put all the labor they can get on the job in order to complete the work at the earliest possible moment. No time is to be lost on the rebuilding of the furnace at Ensley, also belonging to the Tennessee company.

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## DEATH OF ANDREW CORBIN.

Andrew Corbin, brother of Philip Corbin, president of the American Hardware Corporation, and one of the builders of the large industry of P. & F. Corbin, hardware manufacturers, died at New Britain, Conn., Jan. 4. He had been in ill health for three and a half years, which necessitated the giving up of his business responsibilities for treatment in a sanitarium. The strain of large business affairs is believed to have brought on his fatal illness. Mr. Corbin was born in West Hartford, Conn., June 16, 1823, and was, therefore, 83 years of age at the time of his death. He learned the jewelry business, and later became engaged in the manufacture of jewelry, first with the firm of Churchill & Lewis, and then for himself. In 1853 he became identified with the P. & F. Corbin Co., and in 1860, on the retirement of Frank Corbin, one of its founders, was placed in charge of the store in New York. He remained in that city until 1872 when he returned to the factory at New Britain to become general manager, a post he held throughout the remainder of his active business life. He was a man of rare business ability and exerted a strong influence in the affairs of the concern with which he was actively connected. He is survived by a daughter, two brothers and two sisters.

# RAILWAY TRAFFIC AND EQUIPMENT.

## HEAVY EQUIPMENT ORDERS.

Recent orders for freight car construction by various lines include the following: New Orleans Great Northern, 200 box cars from the American Car & Foundry Co.; Philadelphia & Reading, 1,000 coal cars of 100,000 pounds capacity from the Cambria Steel Co.; New Orleans & Northeastern, 150 box cars and 125 flat cars from the American Car & Foundry Co.; Buffalo, Rochester & Pittsburg, 500 cars of 100,000 pounds capacity from the American Car & Foundry Co.; Atlantic Coast Line, 1,500 steel underframe box cars of 60,000 pounds capacity from the South Baltimore Steel Car & Foundry Co., Bangor & Aroostock, 706 box cars and three flat cars from the American Car & Foundry Co.; Duluth, Missabe & Northern, 1,150 steel cars from the Pressed Steel Car Co. and 600 steel cars from the Standard Co.; Colorado Southern, 2,200 steel cars from the Pullman Co.; Pennsylvania railroad, 2,500 box cars of steel underframe construction from the American Car & Foundry Co., and 2,500 box cars of steel underframe construction from the Pressed Steel Car Co.; Illinois Central, 1 500 gondola cars from the Pressed Steel Car Co.; Atlanta, Birmingham & Atlantic, 300 coal cars from the South Atlantic Co. New locomotive equipment has been ordered as follows: Delaware & Hudson railroad, 20 locomotives from the American Locomotive Co.; New River, Holston & Western, one locomotive from the Baldwin Locomotive Works; National Railroad of Haiti, two locomotives from the Baldwin Locomotive Works; Des Moines Union, two locomotives from the Baldwin Locomotive Works.

## CAR SHORTAGE CAUSES.

The causes for the car shortage in the northwest and the consequent coal famine in North Dakota have been reported to President Roosevelt by members of the interstate commerce commission, who conducted the investigation.

"It is a fair inference that the real cause of the coal scarcity in North Dakota was such an abundance of westbound traffic at the head of the lakes that cars were not available at that terminal, for carrying coal to North Dakota—a comparatively short haul for a low-class commodity," says the commission in its report.

As to the charge that the shortage was due to a combination between dealers in coal who fixed prices and refused to sell to outsiders or irregulars, the report said:

"The commission has gained indisputable proof of an agreement between coal dealers to maintain prices and to boycott all who do not so agree; but there is no evidence justifying the contention that this combination is chargeable with the coal shortage, nor that the railroads were a party to such a conspiracy."

The failure of railroads to prepare for a large movement of grain is declared to have caused financial loss to a large percentage of the people of the northwest. The reports shows that the railroads tapping the grain belt seem to have been overwhelmed by this year's crop, although the crop scarcely exceeded that of 1905 and did not equal that of any previous year. A plan for a car clearing house or a car pool is favorably regarded after considering the evidence, the commission says. The most generally advocated remedy for the failure of carriers to furnish cars when demanded is known as reciprocal car demurrage. This phrase means that carriers shall be penalized upon failure to furnish cars asked.

## CANADIAN CONSTRUCTION.

The Trans-continental railway commissioners (Canada) have called for tenders for the construction of five additional sections of the Grand Trunk Pacific or Trans-continental railway, having a total mileage of 457 miles. The following are the sections: From Moncton, New Brunswick, westerly for 50 miles; from Grand Falls, New Brunswick, westerly to the Quebec and New Brunswick boundary, 62 miles; from Quebec bridge, easterly 150 miles; from a point 150 miles west of Quebec bridge westerly to Weymontachene, 45 miles; from a point about eight miles west of the Abitibi river, easterly 150 miles. Tenders must be in by Feb. 14.

The Cincinnati Belt Railway & Terminal Co., of Cincinnati, O., has been incorporated with a capitalization of $100,000 to construct a double-track railroad in Hamilton and Butler counties, O., and extending into Kentucky. A branch line will extend to Hamilton and Middletown. The incorporators are: T. J. Moffett, W. A. Bennett, A. G. Brunsman, M. B. Farrin, Fred A. Geier, James J. Hooker, J. C. Hobart, R. H. West, A. J. Conroy, E. E. Williamson, G. F. Deiterle, Casper H. Rowe, J. T. McHugh and Maurice J. Freiberg.

## BUFFALO FREIGHT ADVANCE.

The New York Central railroad has increased its switching charges at Buffalo 40 per cent. This increase will be absorbed in the freight rate of all other roads leading into the Buffalo district, thus averting what might be termed an additional tax on shippers. It is stated that the Lackawanna and Erie will soon take a similar step. Traffic officials, of Buffalo, are now urging that shippers adopt some community of interest plan whereby the shippers may assist the railroads in facilitating the car movement.

## BUSINESS SPY BLOCKED.

The business spy system has been dealt a blow by the justices of the Court of Special Sessions in New York by their decision upholding what is known as the anti-tipping law. Two men, charged with inducing a third party to get a job at a tinfoil factory and then paying him for information about the business of the concern, were found guilty and fined $100 each. In his opinion Justice Deuel said in part:

"It is not necessary to prove actual damage to the complaining company; all that is required is that the gift or gratuity be given with intent to influence' the action of the employe with relation to the employer's business. In the present case the defendants did not attempt to suborn an actual employe; they hired a spy. Such methods do not appeal to the sympathy of the court."

**Banquets Employes.**—Following a custom established many years ago, the Pratt & Letchworth Co., Buffalo, gave its annual dinner to employes on New Years day. Four hundred were present besides the officials of the company and other friends. O. P. Letchworth, president of the company, addressed the gathering and much good fellowship prevailed.

The National Machine Tool Builders' Association will hold its spring meeting on Tuesday and Wednesday, May 7 and 8, at the Chamberlain hotel, Old Point Comfort, which is directly across the river from the grounds of the Jamestown exposition.

Directors of the Niagara Radiator Co., North Tonawanda, N. Y., have decided to discontinue business, pending reorganization. In the meantime, however, a receiver will be appointed to take charge of the business.

## PERSONALS.

H. T. Woodford has been promoted to the position of assistant superintendent of the Toledo Furnace Co., Toledo, O.

John Birkinbine, president of the Franklin Institute, of Philadelphia, has declined nomination for the coming year. He has held the position for the past 10 years.

William N. McGugin, one of the oldest iron manufacturers in the Hanging Rock district, recently celebrated his 89th birthday at his home in Olive Furnace, O.

David Morgan, who resigned recently as superintendent in charge of the Cambria Steel Co. Republic mine at Republic, Marquette range, has been succeeded by W. A. Siebenthal.

George B. Evans, general superintendent of the Sharon, Pa., plant of the American Sheet & Tin Plate Co., recently tendered a banquet to the heads of departments and clerks.

George M. Basford, formerly in charge of the publicity department of the American Locomotive Co., became assistant to President W. H. Marshall, of that company, Jan. 1.

F. W. Jewell, of Marysville, O., has been elected president and secretary of the Standard Steel Tube Co., Toledo, O., having purchased the interests of E. C. Lee, the retiring president.

W. F. Brown has been made president of the Baldwin Chain & Mfg. Co., of Worcester, Mass. He was formerly with the E. P. Allis Co., Milwaukee, and later with the Brown Corliss Engine Co., Corliss, Wis.

A. B. Conover, manager of the Chicago office of the John A. Roebling's Sons Co., served as toastmaster Jan. 3 at the annual banquet of employes of the Chicago branch held at the Chicago Athletic Club. Karl G. Roebling was guest of honor.

J. A. Whaley, late purchasing agent of the Wisconsin Central Railway Co., has been appointed purchasing agent of the Semet-Solvay Co., of Syracuse, N. Y., effective Feb. 1.

T. B. Walsh, for the past 28 years superintendent of the Frost Foundry at Galesburg, Ill., retired from active connection with that plant Jan. 1. He still continues as a director of the company.

Ben Batchelder, of Iron Mountain, a graduate of Michigan College of Mines, has been appointed superintendent of the International Harvester Co.'s Hawkins mine, a Mesabi range property.

George Burnham, of the firm of Burnham, Williams & Co., proprietors of the Baldwin Locomotive Works, Philadelphia, retired Jan. 1. He was succeeded by Alba B. Johnson.

James Piper, formerly in charge of the Hartford mine at Negaunee, Mich., has left the employ of the Oliver Iron Mining Co., to assume the superintendency of the Alabama iron mines of the Tennessee Coal, Iron & Railroad Co.

Edwin S. Mills, formerly of Cleveland, has been installed as assistant sales manager of the Carnegie Steel Co., at St. Louis, to succeed his brother, James R. Mills, who has been promoted to be sales manager at New Orleans, La.

A number of vacancies on the board of directors were filled at the annual meeting of the stockholders of the Alabama Consolidated Coal & Iron Co., as follows: J. A. Green, of Cincinnati; Guy R. Johnson, of Clarksville, Tenn.; E. K. Hill, of Worcester, Mass., and K. K. McLarren, of Jersey City, N. J.

W. H. S. Bateman, for a number of years connected with the Lukens Iron & Steel Co., Coatesville, Pa., has resigned his position to enter the employ of the Chicago Pneumatic Tool Co., with headquarters in the Arcade building, Philadelphia.

William B. Everest, traffic manager of the Westinghouse Electric & Mfg. Co., has been chosen chairman of the board of governors of the Traffic Club of Pittsburg. This will mean, according to the club's custom, that he will be president of the organization next year.

William H. Lewis, formerly manager of the New Castle, Pa., plants of the Carnegie Steel Co., and manager of the Sharon, Pa., plants of the same concern for the past five years, will on Jan. 15 become general manager of the new Jones & Laughlin steel plant at Aliquippa, Pa.

N. C. Duri, until Jan. 1 assistant manager of sales for the Republic Tennessee interests in St. Louis, has established the Duri Molded Rubber Co., in that city. W. W. Arpie, long associated as salesman for the Republic-Tennessee, will take up the duties heretofore performed by Mr. Duri.

James Asa Childs has retired as superintendent of the Adelaide works of the H. C. Frick Coke Co., near Connellsville, Pa., after 20 years' continuous service. He has been succeeded by Herbert Boyd, formerly superintendent of the Painter mine of that company at McClure, who in turn has been succeeded by Samuel H. Lowe, of Mt. Pleasant.

William B. Leeds, vice president of the American Tin Plate Co., until the concern was merged with the United States Steel Corporation, has left for Paris to undergo treatment for an attack of illness which recently came upon him in New York. Officials of the Rock Island railroad state that the reports of his serious condition have been exaggerated.

William H. Frederick, of Bethlehem, Pa., former traffic manager of the Bethlehem Steel Co. and later general manager for the Ross Common Water Co., has resigned to accept the position of traffic manager for the Black Rock Manufacturers' Association with headquarters at Buffalo, N. Y. Clarence E. Beckel, formerly with the Bethlehem Steel Co., will succeed him as manager of the Ross Common Water Co.

James Gayley, first vice president of the United States Steel Corporation was taken ill while attending the annual banquet of the Carnegie Co., at Pittsburg Jan. 5 and was unable to respond to his toast. His ailment was diagnosed by a physician as grip. President Dinkey of the Carnegie Co., acted as toastmaster at the banpuet and responses were given by L. C. Bihler, L. H. Burnet, Col. H. P. Pope and others.

George M. Summers has tendered his resignation as superintendent of the Connellsville, Pa., plant of the Republic Iron & Steel Co., on account of ill health. Mr. Summers is one of the Republic's oldest employes. About 30 years ago he succeeded his uncle, James Summers, as boss roller on the sheet mill at the Brown-Bonnell plant at Youngstown, O., and later was placed in charge of the Valley plant of the same corporation.

T. J. Wright has been appointed successor to A. O. Backert as western editor of the *Iron Age*, with headquarters in Chicago. Mr. Wright has had a wide experience in the selling of iron and steel products, having formerly been connected with the Western Iron & Supply Co., of St. Louis, and with Joseph T. Ryerson & Son, of Chicago, in the capacity of salesman. He was later identified with the Hartford Steam Boiler Inspection & Insurance Co., acting as special agent in its Chicago office, during which period he contributed many excellent articles to the technical press on steam boiler practice. Mr. Backert will on Jan. 17 enter upon the discharge of his new duties as editor of the *Foundry* and associate editor of THE IRON TRADE REVIEW.

# THE ART OF CUTTING METALS.[1]

By F. W. Taylor.

[Mr. Taylor's paper is of such a monumental character, his experiments are so thorough, and the results obtained and facts presented are so important, that it was deemed unwise to abridge it in the slightest degree. It will be presented in full beginning in this and continuing in the immediately succeeding issues of The Iron Trade Review.—Editor.]

Three principal objects in writing this section of the paper are: To record and make public the results of our experiments to date as embodied in laws, etc., and the incorporation of these laws in slide rules for practical, everyday use; to describe the methods, principles and apparatus which should be used in making investigations of this type, and warn future experimenters against the errors into which we, as well as most other investigators in this field, have fallen; to indicate the additional experiments which are needed to perfect our knowledge of the art, in the hope of inducing others to join us in carrying on and completing this work, both in the interest of science and of the many users of machine tools the world over; and to warn others against a certain class of experiments which are alluring, appear to offer great opportunities, but which, in fact, are fruitless.

The problem before us may be again briefly stated to consist of a careful study of the effect which each of the twelve following variable elements has upon the selection of the cutting speed of the tool:

*a* The quality of the metal which is to be cut, i. e., its hardness or other qualities which affect the cutting speed.

*b* The diameter of the work;

*c* The depth of the cut or one-half of the amount by which the forging or casting is being reduced in diameter in turning.

*d* The thickness of the shaving, or the thickness of the spiral strip or band of metal which is to be removed by the tool, measured while the metal retains its original density; not the thickness of the actual shaving, the metal of which has become partly disintegrated.

*e* The elasticity of the work and of the tool.

*f* The shape or contour of the cutting edge of the tool, together with its clearance and lip angles.

*g* The chemical composition of the steel from which the tool is made, and the heat treatment of the tool.

*h* Whether a heavy stream of water, or other cooling medium, is used on the tool.

*j* The duration of the cut, i. e., the time which a tool must last under pressure of the shaving without being reground.

*k* The pressure of the chip or shaving upon the tool.

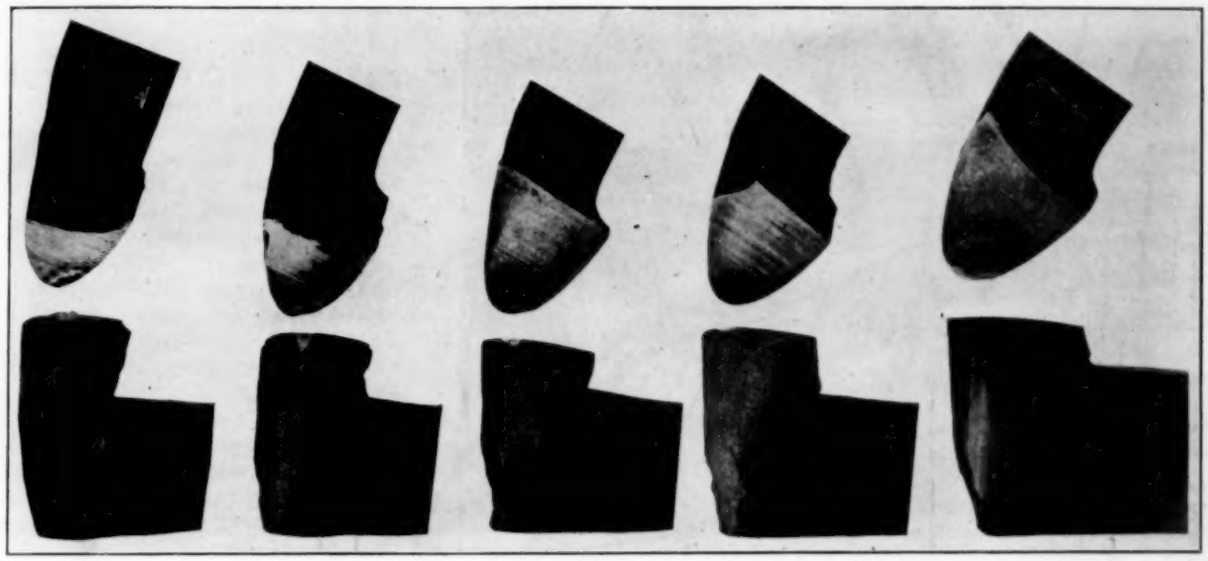
*l* The changes of speed and feed possible in the lathe.

*m* The pulling and feeding power of the lathe at its various speeds.

Before entering upon the details of our experiments, it seems necessary to particularly call attention to the fact that "standard cutting-speed" is the true criterion by which to measure the effect of each of these twelve variables upon the problem.

The effect of each variable upon the problem is best determined by finding the exact rate of cutting speed (say, in feet per minute) which will cause the tool to be completely ruined after having been run for 20 minutes under uniform conditions.

To give an illustration of our practical use of this standard. If, for example, we wish to determine which



(*a*) (*b*) (*c*) (*d*) (*e*)

Fig. 1.—Typical Wear on Modern High Speed Tools Run Close to Ruining Speeds.

Depth of cut 3-16-inch; feed 1-16-inch; cutting hard steel; engravings six-tenths actual size.
(*a*) Steel mounted on lip surface. Small particles of the chip scraped from forging and welded into compact pile on lip surface.
(*b*) Tool ruined from being run at too high speed.
(*c*) Tool in fair condition. Speed slightly too high, and tool showed signs of ruining.
(*d*) Tool in good condition.
(*e*) Tool guttered; cutting edge still good, but deep groove worn in lip surface by pressure of chip.

[1]Being Part II of the presidential address before the New York (Dec., 1906) meeting of the American Society of Mechanical Engineers. Part I appeared in the Iron Trade Review of Dec. 13, 1906.

The subjects treated in this section of the paper are from their nature so dependent one upon the other, and so interwoven, that the writer has had difficulty in treating them consecutively and logically. He therefore trusts that a certain amount of repetition and the necessity for referring frequently from one part of the paper to another will be pardoned.—Author.

make of tool steel is best, we should proceed to make from each of the two kinds to be tested a set of from four to eight tools. Each tool should be forged from tool steel, say, ⅛ inch x 1⅜ inch and about 18 inches long, to exactly the same shape, and after giving the tools made from each type of steel the heat treatment appropriate to its chemical composition, they should all be ground with exactly the same shaped cutting edge and the same clearance and lip angles. One of the sets of eight tools should then be run, one tool after another, each for a period of 20 minutes, and each at a little faster cutting speed than its predecessor, until that cutting speed has been found which will cause the tool to be completely ruined at the end of 20 minutes, with an allowance of a minute or two each side of the 20-minute mark.

Every precaution must be taken throughout these tests to maintain uniform all of the other elements or variables which affect the cutting speed, such as the depth of the cut and the quality of the metal being cut. The rate of the cutting speed must be frequently tested during each 20-minute run to be sure that it is uniform throughout. Further details in making tests are given later.

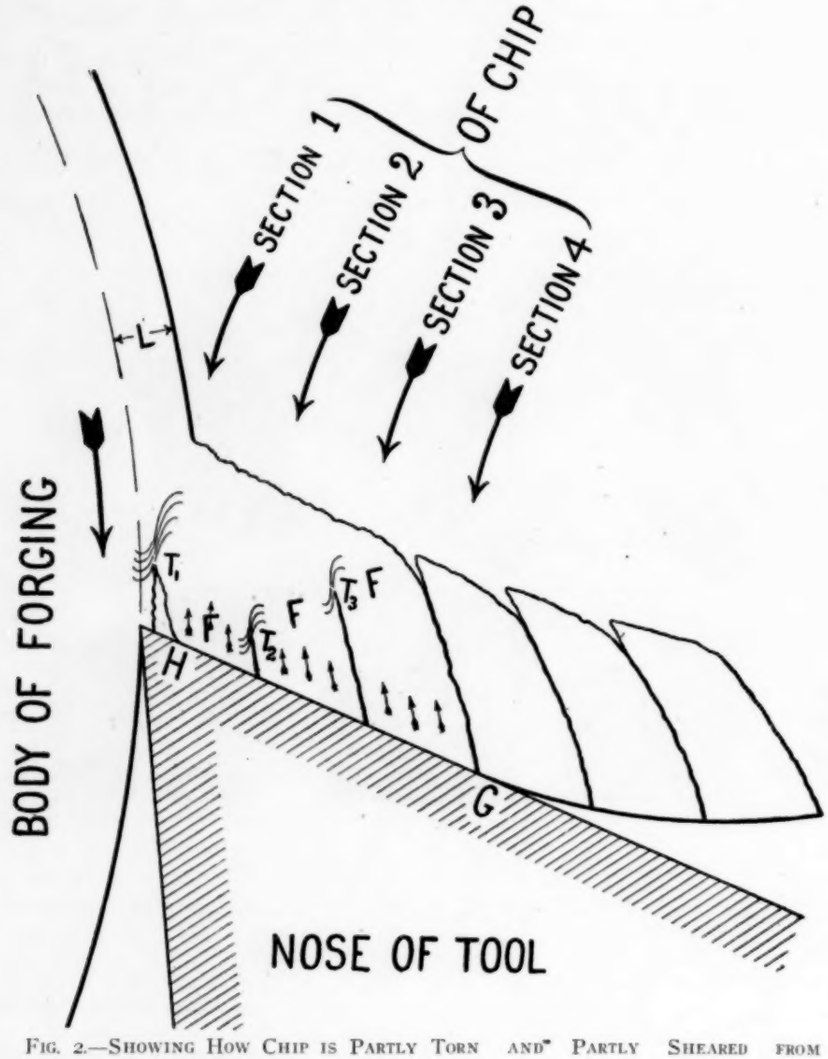



FIG. 2.—SHOWING HOW CHIP IS PARTLY TORN AND PARTLY SHEARED FROM FORGING.

Shearing takes place upon at least two lines of cleavage at same time; cutting edge of tool not under heavy pressure.

Throughout this paper, "the speed at which tools" give out in 20 minutes, as described above, will be, for the sake of brevity, referred to as the "standard speed." After having found the "standard speed" of the first type of tools, and having verified it by ruining several more of the eight tools at the same speed, we should next determine in a similar manner the exact speed at which the other make of tools will be ruined in 20 minutes; and if, for instance, one of these sets of tools exactly ruins at a cutting speed of 55 feet, while the other make ruins at 50 feet per minute, these "standard speeds," 55 to 50, constitute by far the most important criterion from which to judge the relative economic value of the two steels for a machine shop.

Other properties of the steels, as mentioned in later paragraphs under the head of "Tool Steel and Its Treatment," must of course be considered in choosing a tool steel. But if the steels are in other respects equal, their maximum cutting speeds then represent the exact measure of their values.

Perhaps the best criterion by which to judge of the value of any standard or test is the ability to duplicate the results which have been once obtained. We have repeatedly been able to reduplicate the results obtained through this standard within an error of 2 per cent.

**"Standard Speed" Best Test for Determining Value of Tools.**

It seems necessary early to emphasize the importance of the "standard speed" as being the true test for the relative value of tools as well as for the other elements involved in the art of cutting metals—the more so since the accuracy and delicacy of this standard are but vaguely recognized. Among those commonly referred to, the most deceptive and unreliable standard as to the relative value of tools is the length of time a tool will run before requiring grinding or before being ruined. So many people are continually being misled by this standard that its inadequacy can scarcely be over-emphasized.

To illustrate: Let us assume, for instance, that three tools have been proven to be uniform within, say, 2 per cent by our standard method, described above, and to have a "standard speed" of 60 feet per minute for a run of 20 minutes. If then the cutting speed of each of these tools is increased, say, to 63 feet per minute, the length of time which they will run at this slight increase in cutting speed will be almost sure to vary greatly. One of the tools will be ruined, say, in six minutes, another in nine minutes, while the third may last 15 minutes. Thus if tools which are uniform within 2 per cent are run only slightly beyond "standard speed," they are likely to vary to the extent of more than 2 to 1 in time which they last before ruining or requiring regrinding; and so the misleading nature of the standard for all practical purposes becomes apparent.

For many years it has been usual for salesmen of tool steels to give de-

tailed accounts of the number of hours which tools made from their steels, would cut metals without the necessity of regrinding. In fact, tool steel literature abounds in statements of the long life of tools with one grinding, implying that this is the proper standard for measuring their value. It will be shown, however, that for ninety-nine one-hundredths of the work of a shop, this criterion is of no value whatever, and that the man who boasts of having run a tool without regrinding, say, for a longer period than one and one-half hours on ordinary shop work, is merely boasting of how little he knows about the art of cutting metals cheaply.

The writer has already referred in Part 1 to another error into which all experimenters in this art fall sooner or later: namely, that of concluding that the effect which the size, shape and angles of the tool has upon the problem of cutting metals can best be determined by a careful investigation of the effect which each of these elements has upon the pressure required to remove a given sized chip or shaving. The reasoning used is that that tool is the best which is so shaped as to remove a given chip or shaving with the least amount of pressure or cutting force. The utter fallacy of this as a measure of the value of the tool has already been, and will be again referred to.

In Part 1 the writer has described several false standards which were adopted, one after another, for determining when a tool had been run at its maximum cutting speed. Even with these defective standards we obtained most useful results. Broadly speaking, however, our reason for successively abandoning each of these standards was the impossibility of accurately reduplicating the results obtained. And this after all remains the best gage of the value of experimental methods. In all cases the earlier standards adopted by us required very close observation and judgment on the part of the experimenter to determine when the tool had reached that state of deterioration which was appropriate to its highest cutting speed. The advantage of our present standard, namely, that of completely ruining the tool, lies in the fact that it is an unmistakable, clear-cut phenomenon which calls for a minimum of judgment on the part of the operator, and this eliminates one of the sources of human error in the experiments, and enables us to reduplicate our results with accuracy.

Fig. 1b shows several views of a tool which has been completely ruined according to this standard.

## ACTION OF TOOL AND ITS WEAR IN CUTTING METALS.—THE ACTION OF THE NOSE OF THE TOOL.

Figs. 2 and 3 illustrate in enlarged views the action of a tool in cutting a chip or shaving from a forging at its proper normal cutting speed. It may be said in the case of all "roughing cuts" that the chip is torn away from the forging rather than removed by the action which we term cutting. The familiar action of cutting, as exemplified by an axe or knife removing a chip from a piece of wood, for instance, consists in forcing a sharp wedge (i. e., one whose two flanks form an acute angle) into the substance to be cut. Both flanks of the wedge press constantly upon the wood, one flank bearing against the main body of the piece, while the other forces or wedges the chip or shaving away.

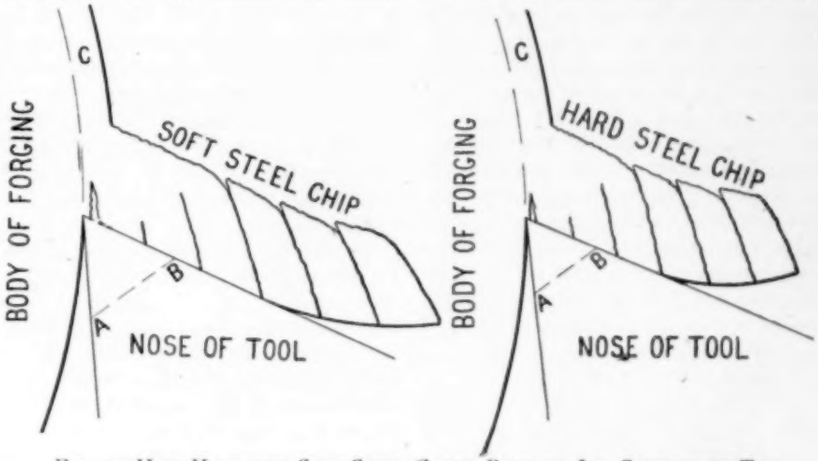



Fig. 3.—How Hard and Soft Steel Chips Bear on Lip Surface of Tool.

While a metal cutting tool looks like a wedge, its cutting edge being formed by the intersection of the "lip surface" and "clearance surface" or flank of the tool, its action is far different from that of the wedge. Only one surface of a metal cutting tool, the lip surface, ever presses against the metal. The clearance surface, as its name implies, is never allowed to touch the forging. Thus "cutting" with a metal cutting tool consists in pressing, tearing or shearing the metal away with the lip surface of the "wedge" only under pressure, while in the case of the axe and other kinds of cutting, both wedge surfaces are constantly under pressure.

After the cut has once been started, and the full thickness of the shaving is being removed, the action of the tool may be described as that of tearing the chip away from the body of the forging and then shearing it up into separate sections; the portion of the chip which has just been torn away, and which is still pressing upon the lip surface of the tool, acting as a lever by which the following portion of the chip is torn away from the main body of the metal.

It may be of interest to analyze to a certain extent the nature of the forces to which a chip and the forging from which it is being removed are subjected through the tearing action of the tool. The enlarged view of the chip, tool and forging, shown in Fig. 2, represents with fair accuracy the relative proportions which the shaving cut from a forging of mild steel (say, 60,000 pounds tensile strength and 33 per cent stretch) finally assumes with relation to the original thickness of the layer of metal which the tool is about to remove. It is, of course, impossible to accurately determine the extent to which various parts of the chip and forging close to the tool are under compression and tension, but in general the theory advanced is believed to be correct.

Referring to Fig. 2, the forging being cut and the nose of the tool which is removing the chip are shown on an enlarged scale. The thickness of the layer of metal about to be removed is indicated by L between the dotted line and the full line which represents the outside of the forging. It will be observed that the chip is in process of being torn apart and broken up into three sections: Section 1, which is adjoining the forging; section 2, which comes next to it, and in which rupture or cleavage has started and proceeded a little way up from the bottom of the chip and on the left hand side, the shearing action having progressed as far as $T_2$; section 3, in which shearing has progressed about two-thirds

of the way to the top of the chip and is taking place at $T_2$. Section 4 has been entirely sheared from its adjoining section, and has already left the lip surface of the tool.

On examination of the proportions of the chip it will be noticed that the width of the sections into which the chip breaks up is at their base about double the thickness of the original layer of metal which is to be removed, and that their upper portions are not enlarged to the same extent. These sections are about three times as high as the original thickness of the layer of the metal to be removed. It should be clearly understood that the dimensions of the section of the chip will vary with each hardness of metal which is being cut, and also to a certain extent with the sides and back slopes of the lip surface of the tool. The harder the metal of the forging, the less will each section into which the chip has been broken up be found to be enlarged. In other words, if the same shaped tool be used in each case the chip from soft metal enlarges or distorts very much more than the corresponding chip from hard steel. This will be referred to in explaining the reason why the total presure on the tool has but little relation on the one hand to the cutting speed, and on the other hand, to the hardness of the metal which is being cut.

The chip bears on the surface of the tool, say, from point H to point G, and throughout this distance is under constant compression from the lip surface of the tool. This compression is transmitted through each of the sections 1 and 2 of the chip, in the direction indicated by the small arrows, to the upper portions of these sections, which are still unbroken and act like a lever attached to the upper part of section 1 to tear section 1 away from the body of the forging, as indicated at point $T_1$. The tearing away of section 1 is also assisted by the pressure of the tool upon its lower surface.

After this tearing action has started the further breaking of the chip into independent sections would seem to be that of simple shearing. It should be borne in mind that in shearing a thick piece of steel the whole piece is not shorn or cut apart at the same instant, but the line at which rupture or cleavage takes place progresses from one surface of the piece down through the metal until within a short distance from the other surface, when the whole remaining section rather suddenly gives way. In shearing steel, the metal at the point of rupture is pulled apart under a tensile strain, although on each side of the shearing line the metal is under heavy compression.

As each of the sections of the chip successively comes in contact with the lip of the tool, its lower surface is crushed, and the metal flows and spreads out laterally until it becomes about twice its original thickness. As in all shearing, when the full capacity for flowing of the metal has been reached, it tears apart under tensile strain from the body of the adjoining metal of the forging. The compression on the chip from the tool still continues, however, and the chips continue to flow and spread out sideways at a part higher up; i. e., farther away from the surface of the tool, at the portions marked F. In the same way shearing continually takes place at the left side of the portion of the chip which is flowing or spreading out sideways.

There is no question that shearing takes place constantly along the left hand edges of two of the sections of the chip at the same time, and it is probable that this action occurs most of the time along three lines of cleavage.

Dr. Nicolson's dynamometer experiments show that the pressure of the chip on the tool in cutting a chip of uniform section varies with wavelike regularity, and that the smallest presure of the chip is not less than two-thirds of the greatest pressure. From this it is evident that shearing must be taking place along at least two lines of cleavage at the same time; since if each of the sections into which the chip is divided were completely broken off before the tool began to break off the following section, it is evident that there would be times when there was almost no pressure from the chip on the tool.

It is at first difficult to see how it is possible for the chip to be shearing at two or three places at the same time. It should be noted, however, that above the points $T_1$, $T_2$, $T_3$, the metal of the chip is still a solid part of the forging, and moves down at the same speed as the forging in a single mass, or body, toward the lip surface of the tool; and with sufficient force to cause each of the three sections of the chip to flow or spread out at the parts indicated by the three letters F. According to the laws which govern shearing, rupture or cleavage in each case must take place as soon as the maximum possibility for flowing has been reached, and in each case shearing must occur at the left of the zone where the metal is flowing.

It is probable that after the shearing action has progressed in section 3 to about the point indicated by $T_3$, that the whole of this section gives way or shears with a rather sudden yielding of the metal from $T_3$ to the upper surface of the chip. It is this rather sudden shearing point which undoubtedly causes the wavelike diminution in the pressure of the chip indicated in Dr. Nicolson's experiments.

By suddenly stopping one of our standard tools when cutting at full speed, we have clearly seen this shearing action taking place at two sections of the chip at the same time, and rupture had not completely taken place at the extreme upper part of the third section. In making an observation of this kind great care must be taken before stopping the lathe to be sure that in the tool to be observed there is not the slightest tendency to chatter, and the lathe driving parts should be massive in proportion to the sized cut being taken, as otherwise the elasticity left in the driving shafts causes an abnormal action of the tool at the instant the work stops, and produces a chip, of thicker section than the normal, which is completely severed from the body of the metal.

While the proportions of the chip and the section into which it is broken are fairly true representations of fact yet it must be borne in mind that the lines illustrating the strains to which the chips are submitted, as well as the progress made in the shearing of the chip, are merely submitted as illustrating a theory advanced by us to explain the facts. We are, however, more or less suspicious of all theories, our own as well as those of others. Throughout this paper the important facts stated by us have been verified by many and carefully made experiments; and we therefore trust that our readers, if unable to accept our theories, will at least have respect for our facts.

### Action of Cutting Edge of Tool is that of Scraping—Cutting Edge Not Under Heavy Pressure.

It would appear that the chip is torn off from the forging at a point appreciably above the cutting edge of the tool and this tearing action leaves the forging in all cases more or less jagged or irregular at the exact spot where the chip is pulled away from the forging, as shown to the left of $T_1$. An instant later the line of the cutting edge, or more correctly speaking, the portion of the lip surface immediately adjoining the cutting edge, comes in contact with these slight irregularities left on the forging owing to the tearing action, and

shears these lumps off, so as to leave the receding flank of the forging comparatively smooth.

Thus in this tearing action, particularly in the case of cutting a thick shaving, while the cutting edge of the tool is continually in action, scraping or shearing off or rubbing away these small irregularities left on the forging, yet that portion of the lip surface close to the cutting edge constantly receives much less pressure from the chip than the same surface receives at a slight distance away from the cutting edge. This allows the tool to run at higher cutting speeds than would be possible if the cutting edge received the same pressure as does the lip surface close to it.

There are many phenomena which indicate this tearing action of the tool. For example, it is an everyday occurrence to see cutting tools which have been running close to their maximum speeds and which have been under cut for a considerable length of time, guttered out at a little distance back of the cutting edge, as shown in Fig. 1e. The wear in this spot indicates that the pressure of the chip has been most severe at a little distance back from the edge.

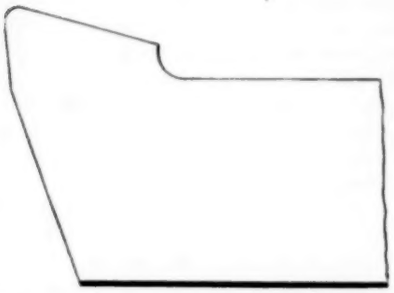


FIG. 4.—CARBON STEEL ROUGHING TOOL.

Showing how cutting edge is sometimes rounded over. Tool in this condition continues to work well.

Still another manner in which in many cases the tearing action of the tool is indicated is illustrated in Fig. 1a, in which a small mass of metal D is shown to be stuck fast to the lip surface of the tool after it has completed its work and been removed from the lathe. When broken off, however, and carefully examined, this mass will be found to consist of a great number of small particles which have been cut or scraped off of the forging, as above described, by the cutting edge of the tool. They are then pressed down into a dense little pile of compacted particles of steel or dust stuck together and to the lip surface of the tool almost as if they had been welded. In the case of the modern high-speed tools, when this little mass of dust or particles is removed from the upper surface of the tool, the cutting edge will in most cases be found to be about as sharp as ever, and the lip surface adjacent to it when closely examined will show in many cases the scratches left by the emery wheel from the original grinding of the tool.

With roughing tools made from old fashioned tempered steel, however, and which have been speeded close to their "standard speeds," in most cases after removing this "dust pile" from the lip surface, the cutting edge of the tool will be found to be distinctly rounded over. And in cases where the tool has been cutting a very thick shaving, the edge will be very greatly rounded over, as shown in the enlarged view of the nose of a tool in Fig. 4.

### Nature of Wear on Tools Depends Upon Whether It Has Been Chiefly Caused by Heat.

The appearance of tools which are worn down so as to require regrinding differs widely according to whether or not the heat produced by the pressure of the chip has been the chief cause of wear; and according to the part which heat has played in producing the wear, worn out tools may properly be divided into three classes.

*The First Class.*—Tools in which the heat, produced by the presure of the chip, has been so slight as to have had no softening effect upon the surface of the tool.

*The Third Class.*—Tools in which the heat has been so great as to soften the lip surface of the tool beneath the chip almost at once after starting the cut, and in which, therefore, heat has played the principal part in the wear of the tool.

*The Second Class.*—Tools in which the heat only slightly softens the surface of the tool during the greater part of the time that it is cutting, while during the latter part of the time heat is the chief cause of wear because, as described in the third class, it greatly softens the lip surface under pressure of the chip.

In the first class, in which heat plays no part in the wear of tools, all tools (whether made from carbon tempered steel, or from the old style self-hardening steel, or from the modern treated tools) wear in about the same manner. Namely, the lip surface just back of the cutting edge is slowly rubbed or worn or ground down through the friction of the chip, as shown in Fig. 1d.

As the surface of the tool through the long rubbing of the chip becomes slightly roughened, the tool wears away somewhat more rapidly; but the increase in the rapidity of wear is in this case by no means marked. On the other hand, tools which wear according to the third class begin to distinctly deteriorate within from one to three minutes after the chip has started to cut, depending upon the length of time required for the friction of the chip to raise the tool from its normal cold state to the high temperature which corresponds to the combination of pressure and speed which produces the heat. And the moment the nose of the tool has reached a degree of heat at which the metal under the chip becomes distinctly soft, the wear then proceeds with great rapidity. Sometimes after arriving at a certain degree of softness, the heat remains approximately constant, and the wear upon the tool continues at a uniformly rapid rate until a comparatively deep groove or gutter has been worn into the lip surface. At other times after the lip surface of the tool begins to soften, it appears to become rougher and causes a still great amount of friction and heat, in which case the wear of the tool proceeds at an increasingly rapid rate, and the tool is soon destroyed. There are rare instances in which after the rapid wear has started, the friction between the chip and the tool, for some unaccountable reason, appears to become less and the tool slightly cools down. Cases have come under the observation of the writer in which tools which had been running with their noses at a visable dark red heat, cooled off to such an extent that the chip which had been very dark blue in color changed to a color but slightly darker than a brown. This indicated a very marked diminution in friction, although the cutting speed was maintained at a uniform rate throughout. This case, however, is of rare occurrence.

While a deep groove worn by the chip is a characteristic of wear of the third class, by no means all of the tools in this class wear into a deep groove. Most of them give out before the groove has had time to wear deep. After wear of the third class has started, tools will generally be completely ruined in a time varying from 20 seconds to 15 minutes, and the time which elapses between the softening of the lip surface and the final ruining of the tool is exceedingly irregular. One of two tools—which have been proved through standardization to be uniform within, say, one

or two per cent, may give out within one minute after this action starts, while the other may last 15 minutes. On the other hand, occasional lots of tools are found which, after having been proved uniform through standardization, will last under this softening speed for approximately the same length of time.

**Reason for Adopting a Standard Test Period of 20 Minutes.**

It is this irregularity in the ruining time of tools belonging to the third class which has led us to adopt a trial period of 20 minutes as being the shortest ruining time from which it is safe to draw any correct scientific conclusions from tests in the art of cutting metals.

A cutting speed which causes the tool to be ruined in a shorter period than 20 minutes is accompanied by such a high degree of heat as to produce irregularity in the ruining time; on the other hand, a speed which ruins at the end of 20 minutes is accompanied by that degree of heat at which tools generally speaking, can be depended upon to wear uniformly. In other words, it represents the degree of heat at which a lot of uniform tools will all give out at about the same time.

**Economical Cutting Speeds.**

Cutting speed which are sufficiently slow to cause the tool to wear as described in the first class are entirely too slow for economy. On the other hand, tools, when run at the high cutting speeds which produce wear of the third class, last so short a time that these high speeds are entirely out of the question for daily shop use.

It is then with cutting speeds causing wear of the second class that we are chiefly concerned; as it is within this range of cutting speeds that almost all roughing tools in every day use should be run for maximum all-round economy. Cutting speeds of this class are referred to as "economical speeds" or "most economical speeds." Our experiments, therefore, have been practically confined to a study of cutting speeds of the second class.

It will be shown later that a cutting speed which will cause a given tool to be ruined at the end of 80 minutes is about 20 per cent slower than the cutting speed of the same tool if it were to last 20 minutes. It will also be noted that, on the whole, we have concluded it is not economical to run roughing tools at a cutting speed so slow as to cause them to last for more than one and one-half hours without being reground. Tools which are ruined in one and one-half hours, however, are still within the second class as far as the causes for wear are concerned; and the wear of tools of the second class may be again referred to as being during the greater part of the life of the tool similar to the wear of the first-class tools, in which the heat is not sufficiently great to materially soften the lip surface. In the second class, however, the cutting speeds are so high as to cause the lip surface of the tool to gradually become rougher and rougher, and as this surface roughens, the heat increases so that in their final wearing out, say, during the last five to fifteen minutes of their life, tools of the second class wear in a manner similar to those of the third class. Thus it is seen that wear in tools of the second class is a combination of the type of wear of the first class with the type of wear of the third class, the first class type of wear extending through the greater part of the time that the tool is cutting.

**How Carbon Steel Tempered Tools and Tools Made From Old Fashioned Self-Hardening Steel Wear.**

With carbon steel tempered tools at standard speeds the cutting edge begins to be injured almost as soon as the tool starts to work, and is entirely rounded over and worn away before the tool finally gives out, and the tool works well in spite of its cutting edge being damaged. With high-speed tools at standard speeds, the cutting edge remains in almost perfect condition until just before the tool gives out, when even a very slight damage at one spot on the cutting edge will usually cause the tool to be ruined in a few revolutions.

Carbon tempered tools and also, to a considerable extent, the old fashioned self-hardening tools (such as Mushet), when run at their "economical" or "standard" speeds, pass through the following characteristic phases as they progress toward the point at which they are finally ruined. It will, of course, be understood that the "rounding of the cutting edge," the "mounting of the steel upon the lip" and the "rubbing away beneath the cutting edge" all progress simultaneously, although each of these phenomena is separately described.

The line of the cutting edge of the tool, which is at first keen, becomes very slightly dull so that it shines when held in the light, and it is then gradually rounded over until it finally loses all resemblance to a cutting edge, and after severe use frequently looks as if it had been purposely rounded over. This action is referred to in recording our experiments as "cutting edge rounded."

The lip, or top surface of the tool, soon becomes slightly roughened and whitened as the shaving presses against it, then the surface of the tool near the cutting edge becomes discolored as if the temper of the tool were being drawn, and this discoloration increases both in the extent of its area and in its approach toward almost a black color, until the tool is entirely ruined. This action is referred to as "discolored back from cutting edge."

The flank of the tool begins to discolor in a manner similar to the lip and this discoloration continues to increase until the tool is finally ruined. This action is referred to as "discolored below cutting edge."

Long before the tool is ruined, also, the fine particles of steel or dust scraped off by the cutting edge begin to weld or stick to the lip of the tool and mount upon it sometimes from 1-16 inch to ¼ inch in height, as shown in Fig. 1, referred to as "steel mounted on lip."

The flank of the tool just below the cutting edge begins to wear or rub away slightly, and this wear gradually extends further and further below the cutting edge until the tool is ruined; referred to as "rubbed beneath cutting edge."

Small portions of the metal being cut wedge themselves in between the flank of the tool and the work, and are partly welded or stuck to the tool, and these lumps which are welded on to the tool, and the rubbing away of the flank as the tool grows dull, prevent the feed from being uniform in thickness, and cause the tool sometimes to entirely skip its feed for one or two revolutions; referred to as "tool jumped." These lumps also force the work and the tool away from one another, and so leave the work rough and lumpy in these places; referred to as "left lumpy finish." Also the particles of metal which are welded on to the flank of the tool frequently leave scratches on the finished part of the work; referred to as "left scratchy finish."

The tool is finally completely ruined by having so much of is flank rubbed away beneath the cutting edge, that no amount of pressure can force it into the work, and when it reaches this condition it must be immediately removed from the tool post, or there

is danger of breaking either the tool, the machine, or the work.

As a result of our experiments it became evident that in case of tools made from the "low-speed" self-hardening steels, for instance, such as the old fashioned Mushet steel, the tools would in many cases run successfully long after the line of the cutting edge had become slightly injured; also that in the case of "roughing" tools made from the carbon or tempered steels, it was economical and right in daily shop practice to run these tools at such a cutting speed that their actual cutting edges rounded off quite soon after starting to do their work. These tools continued to cut with their edges rounded, somewhat as shown in Fig. 4, successfully through the whole cut.

As previously stated, all of our experiments made with these two types of tools (carbon and Mushet types) to determine the laws for cutting metals were rendered much more difficult, owing to the judgment required in deciding the exact amount of damage which was appropriate both to the tool and the particular thickness of shaving which was being taken.

As stated above, in the case of modern high-speed tools, the damage caused by the tool through the action of cutting is confined almost entirely to the lip surface of the tool. Doubtless also the metal right at the cutting edge of the tool remains harder than it is directly under the center of pressure of the chip, because the cutting edge is next to and constantly rubs against the cold body of the forging, and is materially cooled by this contact.

Whether the lip surface be ground away at high speeds or at slower speeds, the nose of the tool is generally "ruined" in a very short time after the cutting edge has been so damaged that it fails to scrape off smoothly even at one small spot the rough projections which have been left on the body of the forging by tearing away the chip. The moment the body of the forging begins to rub against the clearance flank of one of these high-speed tools at or just below the cutting edge, even at one small place, the friction at this point generates so high a heat as to soften the tool very rapidly. After a comparatively few revolutions, the cutting edge and flank of the tool beneath it will be completely rubbed and melted away, as shown in Fig. 1b.

The above characteristic of holding their cutting edges in practically perfect condition while running at economical speeds up to the ruining point is a valuable property of the high-speed tools, since it insures a good finish, and the maintenance throughout the cut of the proper size of the work, without the constant watchfulness required on the part of the operator in the case of old slow-speed tools with their rounded and otherwise injured cutting edges, which when run at economical speeds were likely at any minute to damage the finish of the work.

When one of these high-speed tools is nearing its ruining point, a very trifling nick or break in the line of the cutting edge will be at once noticed by its making a very small but continuous scratch, projecting ridge, or bright streak, on the flank of the forging (namely, upon that part of the forging from which the spiral line of the chip has just been removed) When the skilled operator notices this line, he at once removes the tool from its cut, and notes upon the record "tool began to ruin;" the abbreviation for which in our case consists of the letters B R. The letter R is used to indicate a tool which has been entirely ruined; the word "good" (G) indicates a tool which is removed from the cut showing but very small damage or wear even to the lip surface; the word "fair" (F) indicates a tool which shows considerable wear upon the lip surface, such, for instance, as is shown in tool, Fig. 1d, the cutting edge of which has, however, not as yet absolutely started to ruin.

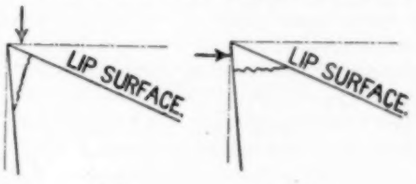



Fig. 5.—Two Ways in which Tools Spall Off or Crumble at Cutting Edge.

(a) From the downward pressure of the chip.
(b) From the pressure on clearance flank due to feeding tool.

It is a curious fact that high-speed tools which differ in their chemical compositions, and perhaps also slightly in their high heat and subsequent treatment, give very different indications while cutting that they have begun to ruin. For instance, the kind of scratch, shiny streak, or ridge, which on high-speed tools made from one chemical composition would indicate the approach of the ruining point, may possibly be no indication of the approach of the ruining point if made by another type of high-speed tool. It is therefore necessary for the operator with each new batch of tools which are to be used in an experiment to absolutely ruin a number of these tools so as to be thoroughly familiar with that exact appearance of the flank of the forging which unquestionably indicates the approach of the ruining point. After the operator has assured himself beyond doubt of this indication, it will not then be necessary for him to ruin each tool completely. The writer has in mind many instances, however, in which from the appearance of the scratches or shiny streaks, etc., on the flank of the forging, he was convinced that the tool was about to ruin, and in which the same tool continued to run for many minutes afterward, and even, in some cases, at an increase in cutting speed. In this element, then, as in all others, nothing must be taken for granted, everything must be proved.

Two other reasons for the cutting edges of tools giving out are:

*a* The spalling off or crumbling away of the tool due to the pressure of the chip at its extreme cutting edge, as shown in Fig. 5a; and

*b* The spalling off or crumbling away of the extreme cutting edge due to the feeding pressure at this point, as shown in Fig. 5b.

As both of these types of yielding must be chiefly considered in their relation to the acuteness of the lip angle of the tool, we refer to them later in the paper.

(To be continued).

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**Long Steel Foot Bridge.**—With the erection of the new steel foot bridge over the tracks of the Pennsylvania lines at the foot of Twentieth street and into the Columbus, O., shop of the company, one of the most dangerous railroad crossings in that city is eliminated. The bridge will not be over 12 feet wide, but it will span 35 tracks and will be about 800 feet long. The bridge was ordered of the American Steel Co. over a year ago, but on account of its being special work, shipment was delayed. This is one of the busiest points in the Columbus yards of the Pennsylvania lines. Freight trains and cuts of cars are being continually shifted back and forth, fast passenger trains pass by hourly, and 2,000 employes of the shops take their lives in their hands daily in getting to and from their work.

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The Kinney mine of the Republic Iron & Steel Co. is to be prepared for a 500,000 ton shipment in 1907.

# FORTY-TWO YEARS IN THE IRON TRADE.

## WONDERFUL INCREASE IN PRODUCTION IN SPITE OF PANICS,

### Foreshadowing Startling Figures for the Next Half Century.—Half a Billion Tons of Pig May be Made in 1950.—The Ups and Downs of the Business and Their Causes, Political and Industrial.

By Dr. William Kent.[1]

In the year 1872 the writer, while employed in an iron works in New Jersey, began his study of the statistics of the iron industry. That year was the one in which the first great boom in pig iron production occurred, the total product reaching 2,548,713 gross tons, as compared with 1,706,793 tons in 1871. The next year saw the beginning of the great depression which followed the failure of Jay Cooke & Co.

In the year 1884 he presented a paper at the Philadelphia meeting of the American Association for Advancement of Science, containing a table of statistics and a diagram of the production and prices of iron and steel in the United States for the twenty-four years, 1860 to 1883, inclusive. A study of the figures and the diagram, together with a comparison of the number of miles of railroad built in each year, and the estimated cost of such railroad, led to the conclusion that the great depressions in business in the years 1873 to 1877 and 1883 to 1885 were chiefly caused by irregularity in railroad building. The difference between the cost of the railroads built in the year 1872 and those built in the year 1875 was calculated to be not less than $240,000,000, and the decreased expenditure for labor in building them and in producing the materials used in their construction and equipment was equivalent to the discharge of an army of half a million men from remunerative employment. The decrease of the amount of capital invested was greater than the whole amount of the capital invested in all the iron works or in all the cotton mills in the country. It was equal to more than half the value of our total exports in 1870, equal to our total exports to Great Britain in 1880, and more than equal to our total export of wheat in 1880.

The fluctuations in the expenditure of capital in the building of railroads were greater than those caused by any difference in crops, either here or abroad, in imports and exports, or by any difference in the expenditure for labor and material in any other branch of industry.

The evils of the fluctuations in railroad building were intensified by the enormous fluctuations in prices of iron and steel, as well as in wages of labor, so that in the years when a large mileage was built the cost per mile was vastly greater than in the years when there was a small mileage. The cause then assigned for these fluctuations was the "insanity of capital," which led men to build railroads when they cost most to build, and not to build them when they cost the least.

In a paper published in the *Engineering and Mining Journal* of September 27 and October 4, 1890, the writer gave the results of his further studies and showed that the consumption of iron and steel by the railroads had become such a small percentage of the total production that fluctuations in production and prices could no longer be attributed to the fluctuations in railroad building. The following table down to the year 1889 was given in the paper referred to, and it is now continued down to the year 1906:

| Years of slow railroad building. | | Years of rapid railroad building. | |
|---|---|---|---|
| Year | Miles | Year | Miles |
| 1860 | 1,837 | 1869 | 4,615 |
| 1861 | 660 | 1870 | 6,078 |
| 1862 | 834 | 1871 | 7,371 |
| 1863 | 1,050 | 1872 | 5,878 |
| 1864 | 738 | 1873 | 4,097 |
| 1865 | 1,177 | | |
| 1866 | 1,716 | Av. for 5 yrs. | 5,608 |
| 1867 | 2,449 | | |
| 1868 | 2,979 | 1879 | 4,800 |
| | | 1880 | 6,706 |
| Av. for 9 yrs. | 1,493 | 1881 | 9,846 |
| | | 1882 | 11,569 |
| | | 1883 | 6,745 |
| 1874 | 2,117 | Av. for 5 yrs. | 7,935 |
| 1875 | 1,711 | | |
| 1876 | 2,712 | 1886 | 8,018 |
| 1877 | 2,280 | 1887 | 12,876 |
| 1878 | 2,665 | 1888 | 6,900 |
| | | 1899 | 5,162 |
| Av. for 5 yrs. | 2,297 | 1890 | 5,378 |
| | | 1891 | 4,075 |
| 1884 | 3,923 | 1892 | 4,441 |
| 1885 | 2,975 | | |
| | | Av. for 7 yrs. | 6,693 |
| Av. for 2 yrs. | 3,449 | | |
| | | 1899 | 4,008 |
| 1893 | 2,346 | 1900 | 3,441 |
| 1894 | 1,899 | 1901 | 4,484 |
| 1895 | 1,650 | 1902 | 4,266 |
| 1896 | 1,704 | 1903 | 4,675 |
| 1897 | 1,822 | 1904 | 5,003 |
| 1898 | 2,219 | 1905 | 4,979 |
| | | 1906 | 6,067 |
| Av. for 6 yrs. | 1,940 | | |
| | | Av. for 8 yrs. | 4,615 |

The following is an extract from the paper of 1890, with a few slight changes in the last paragraphs, bringing the figures down to 1892:

Reviewing the whole field, as shown in the plotted diagram, the period of thirty years, from 1860 to 1899, inclusive, may be divided into six periods, each having strongly marked characteristics:

*First.*—The period of moderate development, from 1860 to 1868, inclusive, in which railroads built, pig iron and rails produced and number of immigrants all increased at a comparatively even rate. In this period the fluctuation of prices (currency) appears to vary rather on account of fluctuations in the price of gold than on account of varying supply of, or demand for iron.

*Second.*—The first period of violent development, 1869 to 1873, inclusive, in which railroad building, pig iron and rail production, importation, prices and immigration all enormously increased, the period culminating in the building of 7,379 miles of railroad in 1871; in the production of over 2,500,000 gross tons of pig iron in each of the years 1872 and 1873; in the production of 1,900,000 and the importation of 1,000,000 net tons of rails in two years; in prices of pig iron and of iron rails more than double those of 1860, and in the unprecedented immigration of 437,750 persons, or nearly five times the number in 1860.

*Third.*—The long period of depression, 1874 to 1878, inclusive, characterized by small yearly increase of railroad mileage, diminished production and greatly diminished prices of pig iron and of rails, by nearly stationary production of rolled iron other than rails, by greatly diminished immigration, and by the almost absolute cessation of rail importations. In this per-

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iod the production of steel rails increased (due to a remarkable development and cheapening of the Bessemer process), but the production of iron rails diminished more rapidly than that of steel rails increased, so that the total rail production was diminished.

*Fourth.*—The second period of violent development, from 1879 to 1883, inclusive, characterized by rapid increase in railroad building, in production of pig iron, production and importation of rails, in immigration and in prices. The prices of iron and steel rails and of pig iron more than doubled between January, 1878, and February, 1880, reaching their extraordinary maximum in the culmination of the "boom" at the latter date, between one and two years before the production of pig iron and rails, and immigration, reached their maxima for that period. In 1882 the production of pig iron and of steel rails reached a figure which was not again reached till 1886.

*Fifth.*—The short period of depression, the two years of 1884 and 1885, when railroad building was less than one-third of that of 1881 and 1882, production of pig iron decreased 12 per cent, prices of pig iron declined 30 per cent below the average figures of 1882, and 36 per cent below those of 1880, and immigration fell off from 730,349 in 1882 to 332,361 in 1885. The fortunate thing about this period of depression was that it was a short one. Production, prices, railroad building and immigration did not go as low as they did in the long period of depression, 1874 to 1878, inclusive. As prices were not so high before the depression as they were in 1872, they did not have so far to fall, and therefore the depression caused less disaster to business.

*Sixth.*—The period of rapid but not violent development, which lasted until 1892, including the slight depression in 1891.

The beginning of this period was in 1886, when the number of miles of railroad built was 8,018 as compared with 2,975 miles in 1885, and when the production of pig iron increased in one year from 4,044,526 to 5,683,329 gross tons. The condition in 1885 was in general similar to that in 1878, when railroad building, production and prices of iron, and immigration were all at a low ebb, and, judging from the experience of the boom of 1879, a similar boom might have been expected in 1886. But there was one most important condition in which 1885 and 1878 were altogether dissimilar, namely, the preparation of the iron works for meeting a sudden increase of demand. In the long depression between 1874 and 1878 there was a stagnation not only in production but in preparation to produce. Old furnaces long out of blast were allowed to fall into ruin, the substitution of steel for iron rails had caused many old rail mills to be dismantled and abandoned, and in but very few even of the larger works were any adequate preparations made for the demand for railroad material which came suddenly in 1879. The same was true in the development of iron ore and coal mines, of coke ovens, and of facilities for transporting material. So in 1879 the country was obliged to import great quantities of iron ore and pig iron, causing a rise in the price of iron all over the world, and an actual famine in Connellsville coke took place, so that the price at the ovens rose from 90 cents to $5.00 per ton. Within one year, however, after the beginning of the boom of 1879 so great was the rapidity of building new blast furnaces and rolling mills and the repairing and starting of old ones, the opening and developing of mines and the building of coke ovens, that the capacity of production was brought up to the demand, and prices soon fell to a normal level.

The building of new works and the development of mines continued steadily from 1879 to 1892, so that at no time since 1880 was there any deficiency either in the ore or fuel supply or in the producing capacity of the works. In consequence of this increase in capacity there was, notwithstanding the tremendous increase in railroad building, from 2,930 miles in 1885 to 12,872 miles in 1887, and in production of pig iron from 4,044,526 tons in 1885 to 9,157,000 tons in 1892, no great increase in prices. During the six years, 1883 to 1891, inclusive, the average yearly prices of pig iron varied between $22⅜ and $17½ per ton.

The fluctuations in railroad building, which were apparently the controlling influence on the trade in the twenty years from 1868 to 1887, inclusive, ceased to have such an influence. The following figures show the percentage which the total amount of rails made bears to the total amount of pig iron made:

| Year. | Per Cent. |
|---|---|
| 1868 | 31.6 |
| 1869 | 31.0 |
| 1870 | 33.2 |
| 1871 | 40.6 |
| 1872 | 35.0 |
| 1873 | 31.8 |
| 1874 | 27.1 |
| 1875 | 35.0 |
| 1876 | 42.0 |
| 1877 | 33.0 |
| 1878 | 33.8 |
| 1879 | 36.2 |
| 1880 | 34.0 |
| 1881 | 39.7 |
| 1882 | 32.6 |
| 1883 | 26.4 |
| 1884 | 24.9 |
| 1885 | 24.1 |
| 1886 | 28.1 |
| 1887 | 33.3 |
| 1888 | 21.6 |
| 1889 | 20.0 |
| 1900 | 17.3 |
| 1905 | 14.7 |

The history of the trade for 1889 to 1905 is easily compiled by a study of the admirable work of Mr. James M. Swank in his annual report of the American Iron and Steel Association, from which all of the figures previously given have been taken. The following is a brief review of the principal events in the trade, using in most cases Mr. Swank's own words:

**Eighteen Hundred and Eighty-Nine.**

This year was characterized by the rapid substitution of steel for iron. During the first five months the depression in prices of 1888 was continued. The last seven months, prices advanced with great rapidity.

**Eighteen Hundred and Ninety.**

Prices began to weaken in January and continued downward, due to the fact that the demand was not keeping pace with the increasing productive capacity. In the latter part of the year the country was not so prosperous as in the beginning. Floods, rainfalls, tornadoes, fires and the "grippe" were characteristic of it. Wool growers and manufacturers were suffering from low duties. Many woolen mills were idle. The production of anthracite diminished. For several years there had been depression in agricultural industries with very low prices for farm products. Notwithstanding all this trouble, the year 1890 was a year of the greatest production of pig iron up to that date and in the latter part of the year it seemed as if the industry was bound for a long season of prosperity, but just before the close of the year a financial panic originating in London in November as the result of South American speculation checked the demand for iron and steel and a severe reaction in the iron trade set in. The year 1890 was also noted for the passage of the McKinley tariff bill, which among other things provided for a duty of 2.2 cents a pound on tin and terne plates after July 1, 1891, with the proviso that plates lighter than 63 pounds per 100 square feet should be admitted free of duty after Oct. 1, 1897, unless by that date the quantity made in the United States exceeded one-third of the amount imported in any year between 1890 and 1897. This was the beginning of the tin plate industry in the United States.

**Eighteen Hundred and Ninety-One.**

This was a year of reaction in the productive industries of all manufac-

turing countries. During the first three months the panicky feeling caused by the Baring failure in 1890 was in full force in this country in all trade circles. By April, 1892, the situation was still unsatisfactory. The coke strike, lasting from February to May, 1891, checked production. There was a greatly decreased demand for iron and steel by the railroads.

**Eighteen Hundred and Ninety-Two.**

A general recovery from the effects of the Baring failure took place, but prices, which had fallen all through 1891, fell to still lower figures in 1892, reaching a lower average than ever before known. Other industries recovered their normal prosperity in 1892. The iron industry did not. Many failures occurred. There was a great shrinkage in the grain market and grain declined in price. The principal cause of the depression in prices in 1892 was stated to be our capacity to produce much more iron and steel than the country could consume. The annual capacity of all the blast furnaces increased from 11,757,351 gross tons in November, 1899, to 14,550,708 gross tons in January, 1892. Yet in 1890 we produced more pig iron than in 1892. Consumers knew there could be no scarcity in the supply of pig iron, hence they were never eager buyers and bought only as their wants required. The prospect of sharper competition with foreign manufacturers consequent upon the expected reduction of duties discouraged the hope that any considerable improvement in prices was probable in the near future. The Homestead strike took place in 1892. The trouble lasted from June 29 to Nov. 20, when the strike was officially terminated by the union, but all the works of the Carnegie company were then running non-union. In November, 1892, occurred a political revolution, in the election of a Democratic president and a Democratic congress.

In the early months of 1893 the demand for iron was still large, but at lower prices. Many failures and suspensions. Decreased demand for all products. A revision of the tariff had been promised by the leaders of the Democratic party which had just been restored to power, and the future value of manufactured goods and raw materials was therefore uncertain. Hence the hesitation of buyers in placing orders. Beginning with the earlier months of 1892, the tightening of the money market took place. There was an enormous liquidation, resulting in a great decline in values. In May a panic of immense proportions had precipitated itself upon the country, equaling perhaps in its consequences any of the great panics of 1837, 1857 and 1873. Business declined throughout the year. Over 100 failures occurred among iron and steel manufacturers and ore producers. A special session of congress on Nov. 1, 1893, repealed the silver purchasing clause of the Sherman act. This legislation did not accomplish the results in improving business that were desired for it.

On Dec. 19, the Wilson tariff bill was reported to the house of representatives. "Thus there was presented the miserable spectacle of a new administration deliberately planning at a time of great public distress to increase this distress by giving encouragement to foreign manufacturers seeking our markets and by discouraging our own manufacturers and other employers of labor." A substitute for the Wilson bill embodying much more favorable consideration of American interests passed the senate and on Aug. 13, 1894, passed the house.

**Eighteen Hundred and Ninety-Four.**

Thus the original Wilson bill was defeated. While the tariff agitation lasted, the industries of the country remained in a state of prostration. The passage of the senate substitute brought a feeling of relief to the country and orders were given out which had long been withheld. Production began to increase, but prices fell from July, 1894, to 1895. In the latter half of 1894 cotton and wheat prices both reached the lowest points known for a generation.

**Eighteen Hundred and Ninety-Five.**

In May, 1895, Mr. Swank wrote, "No considerable advance in the present prices of iron and steel is now looked for. In other branches of domestic and manufacturing industry, no more hopeful expectations are entertained. In November, 1894, the people condemned by an overwhelming majority the tariff legislation which had been proposed by the present administration and the mere threat of which they hold responsible for most of the financial and industrial troubles of the last two years."

As soon as trade conditions improved early in 1895, the works were overwhelmed with orders and taxed to their utmost capacity. Prices rose rapidly from May to December, when a reaction occurred. This was the iron and steel boom of 1895. The lowest prices were in January, 1895, when Bessemer pig iron at Pittsburg was quoted at $10. In September the price of pig rose to $17.75 and billets to $25.00

**Eighteen Hundred and Ninety-Six.**

During the first quarter there was a distinct slackening in the demand. The reaction in 1895 from the prostration of 1893 and 1894 was remarkable in the magnitude of the results, yet the production of pig iron was only a trifle greater than it had been five years before and it was not until three years later, or in 1898, that a yearly rate of increase approaching that of the six good years, 1885 to 1890 inclusive, had actually set in. There were, therefore, following 1890, seven lean years in the iron trade. The normal business condition of this country is one of steadily advancing production of every salable commodity in a greater ratio than that of the increase in population. In the seven years from 1890 to 1897 the increase of pig iron had been only from 9,202,703 to 9,652,680 gross tons, an increase of less than five per cent, while the population increased approximately from 62,622,000, to 71,900,000 or 15 per cent.

**Eighteen Hundred and Ninety-Seven.**

This year was a reaction from the boom of 1895. Prices fell steadily to the lowest ever known and wages were reduced. There was a decline in production as compared with 1895. The country as a whole was not prosperous under the Wilson tariff. When Mr. Bryan was named for the presidency in 1895, all business interests were paralyzed, almost as seriously as after the panic of 1893. In November the iron trade was in a state of great depression. With the election of President McKinley an improvement at once took place, but it was only temporary and the year closed in great dullness. The production of iron and steel was less than in 1895.

Some of the probable causes of the bad conditions of business in the first half of 1897 according to Mr. Swank were:

1. Distrust of the country's future in financial circles, the ghost of Bryanism not having been fully laid.

2. The depreciation in price due to a capacity for production in mining, manufacturing and agricultural interests greatly in excess of our consuming capacity.

3. The mistake made in building railroads that were not needed.

Another cause seems probable to the present writer. It is that sufficient time had not elapsed since the panic of 1893 to effect a complete recovery. It took over five years to recover from the panic of 1873 and that of 1893 was nearly if not quite so severe. The normal condition of business in the United States during good years is one of general employment of all

workers at good wages; from average to large profits in all industries and commercial enterprises; a rapid increase of actual wealth taken from the ground, much of which is available in the shape of dividends for new investments; and, lastly, large courage and even mild speculative feeling on the part of capitalists, leading them to invest in new enterprises. It is the building of new railroads, factories and other structures that distinguishes a year of prosperity from one of dullness. The first two years after a panic are characterized by great shrinkage of values, diminution of dividends, bankruptcies, men thrown out of employment and living on their savings and an actual decrease of money for starting of new enterprises. The next two years are years of slow recovery, but it takes a long time to accumulate enough money to start new enterprises and to get the confidence necessary to start them.

On July 24, 1897, the Dingley tariff bill became a law. Business at once improved and it continued to improve through the remainder of the year until in September, 1898, Mr. Swank says, "In the period which has elapsed since the Dingley tariff bill became a law there has been a greater activity in this country than in any period of twelve months since 1892. On June 1, 1897, prices of iron and steel reached the lowest figures on record. Steel billets in May were sold at $13.85 per ton; in June, $14.00; September, $15.16; October, $16.50 to $16.75; November, $16.50, dropping to $:6.00; December, $15.00.

In September, 1898, Mr. Swank says that prices and profits were kept down by the existence of a capacity for production far in excess of the demand. It appears, says he, to be inevitable that many of our still active iron and steel works that are neither well situated nor equipped with the best appliances for cheap production or which can make iron only and not steel, must give up the struggle for existence. "Except under the most favorable conditions, this is no time to build new iron or steel works."

In the writer's opinion, the time to build new iron and steel works is just such a time as 1897 when prices are lowest, even if at such a time there is a great excess of productive capacity, provided these works are built in a good location and that they secure their own supplies of raw material.

The war with Spain which began April 12, 1898, gave a shock to business confidence, but it also stimulated many branches of productive industry.

**Eighteen Hundred and Ninety-Eight.**

In May, 1899, Mr. Swank wrote, "The demand for manufactured articles has steadily increased. The foreign demand for our surplus agricultural products has been well maintained. The carrying capacity of our railroads has been taxed to the utmost. Prices have risen and wages advanced.

The year 1898 marked the beginning of an enormous consolidation of iron and steel firms and corporations which reached a climax in the formation of the United States Steel Corporation in 1901. The export trade in manufactures of iron and steel also received a great impetus. The following interesting comparison shows the complete reversal of the condition of our imports and exports of iron and steel between 1880 and 1898:

| Year. | Exports. | Imports. |
|---|---|---|
| 1880 ..... | 15,156,703 | 80,443,362 |
| 1896 ..... | 48,670,218 | 19,462,561 |
| 1897 ..... | 62,737,250 | 13,836,204 |
| 1898 ..... | 82,751,550 | 12,473,637 |

**Eighteen Hundred and Ninety-Nine.**

Writing in May, 1900, Mr. Swank says, "All in all, the year 1899 was the most prosperous in our history. In that year a boom took place of far larger proportions and of longer continuance than the celebrated iron and steel boom which began in the latter part of 1879 and came to a sudden termination in February, 1880." A moderate advance in iron and steel prices commenced in December, 1898, following two years of expanding production but of low prices. After the middle of the year, prices advanced by leaps and bounds until October. In November the boom practically ended. The prices which had been established at this time averaged an increase of over 100 per cent over the price which had prevailed eleven months before and in some cases the increase greatly exceeded 100 per cent. Bessemer pig iron at Pittsburg rose from $10.45 to $25. Steel rose from $17 to $35. Billets from $15.25 to $43. Wire nails from $1.35 to $3.28. From November, 1899, to March, 1900, there was a moderate yielding of prices and a more distinct yielding in April and May. Mr. Swank says (May, 1900) that prices of iron and steel in American markets advanced in 1899 because the demand was greater than had ever been before known and because early in the year the impression became general that our capacity for production was not equal to the country's wants. Much of the scarcity that was here and there developed was due to the inability of the railroad companies to supply cars for the transportation of the raw materials. All the furnaces that could be put in operation were constantly employed. Producing capacity was greatly increased. New iron and steel works were built. Old iron ore mines were reopened. The reaction from the four year's depression following the financial panic of 1893 was at full tide through 1899.

It is interesting to note that while in September, 1898, the conditions were such as to lead Mr. Swank to write "This is no time to build new iron and steel works," it was necessary to build new works in 1899 to meet an unequaled demand which caused an advance in price of over 100 per cent. Those manufacturers who had the foresight to build new iron works in the right locations just at the date when it was said that "this is no time to build new works," reaped fortunes.

**Nineteen Hundred.**

This year was one of the most prosperous years in the history of the American iron trade up to that date. The whole country had enjoyed a period of extraordinary prosperity since the beginning of 1899.

**Nineteen Hundred and One.**

The story of prosperity continues. Mr. Swank writes in June, 1902, "While a reaction is bound to come some day from causes which no prophet can foretell, it seems reasonably certain they will be continued far into 1903, perhaps longer. A conservative spirit has grown up which will strongly tend to prevent the recurrence of booms and inflated prices which increase importations, check buying at home and in the end close factories."

**Nineteen Hundred and Two.**

In June, 1903, Mr. Swank wrote, "The extraordinary prosperity that prevailed a year ago has continued to the present time and it bids fair to continue for some time without serious interruption." A warning is sounded in these words: "Prosperous as this country is and has been for several years, it is not so prosperous that it can digest all of the speculative schemes that are continually being offered to the credulous and unthinking." Interruptions to the general prosperity in 1902 included the anthracite coal strike and the inability of many railroads to promptly handle all the freight that was offered to them, due not only to lack of cars and locomotives but to lack of track facilities to accommodate the cars. There was an increase in the importation of iron and steel products to meet the deficiencies in the home supply and a decline in the exports of these products.

**Nineteen Hundred and Three.**

This was the year of the "little panic"

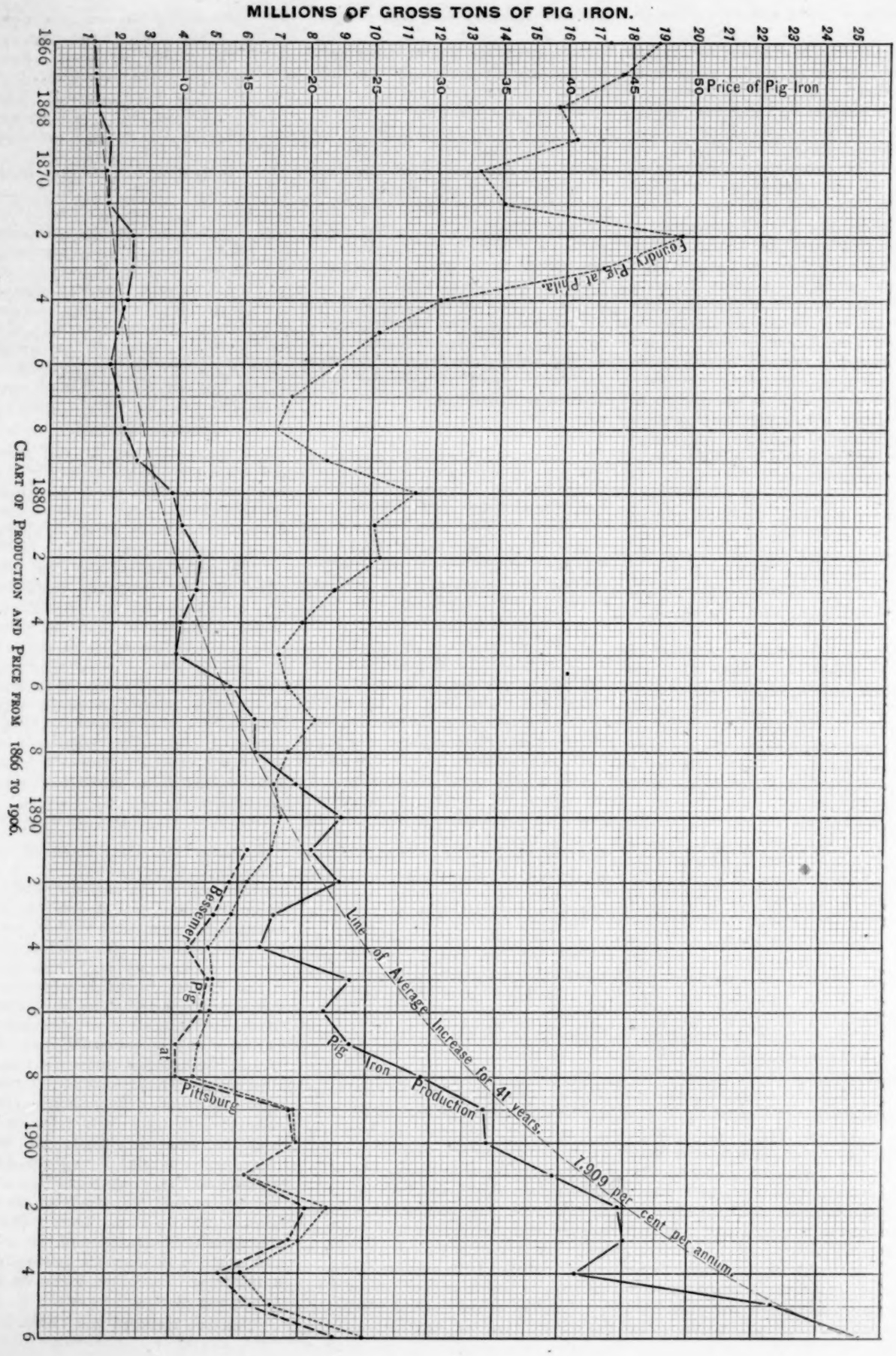
MILLIONS OF GROSS TONS OF PIG IRON.
Price of Pig Iron
Foundry Pig at Phila.
Bessemer Pig at Pittsburg
Pig Iron Production
Line of Average Increase for 41 years, 7.909 per cent per annum.

CHART OF PRODUCTION AND PRICE FROM 1866 TO 1906.

similar to that following the Grant and Ward failure in 1884. In June there was a rapid decline in the stock market, attributed to the over production of "undigested securities." As the year wore on the prices of stocks further declined and confidence waned. Production and prices of iron and steel declined in the latter half of the year, but the total production for the year was slightly greater than in 1902. The price of Bessemer pig iron at Pittsburg fell from $22.85 in January to $14.40 in December. One good effect of the reaction in the stock market was its repressing influence upon all speculative and unwise schemes that could not now be successfully launched.

**Nineteen Hundred and Four.**

The depressing conditions of 1903 continued so that the production of iron fell off 1,500,000 tons. The price of Bessemer pig at Pittsburg went from $13.66 in February to $14.19 in April, $12.46 in July, $13.10 in October, and then the reaction was at an end, for in November the prices rose to $15.15 and in December to $16.72. The "little panic" of 1903 influenced the iron trade for less than eighteen months and it did not cause a serious trouble in the trade, for the pig iron production fell off only about six per cent as compared with 1903.

**Nineteen Hundred and Five.**

The revival which set in in October, 1904, continued through the whole of 1905. "This year," says Mr. Swank, writing in June, 1906, "was not only the most productive and most prosperous year in the history of the trade but it was also the most uniformly prosperous. Production was abnormally and phenomenally great but prices kept within reasonable bounds. The increase in the production of iron and steel was marvelous. That of pig iron jumped from 16,497,033 tons in 1904, to 22,992,380 tons in 1905 and steel from 13,859,887 to 20,023,907 tons."

**Nineteen Hundred and Six.**

The remarkable prosperity of 1905 continued throughout the year 1906. The production of pig iron for the year will probably show a total of about 25,300,000 tons or ten per cent increase over the figure of 1895. The price of Bessemer pig at Pittsburg remained steady during the first half of the year, the whole range of monthly average prices being only from $17.24 to $17.38, but in July a very slight advance set in which reached the proportions of a mild boom in the latter part of the year, the average figures in September being $18.44, October, $20.06, November, $21.96; December, $22.75.

**The Future Outlook.**

In his paper in the *Engineering and Mining Journal* in October, 1890, the writer made the following comment on the situation of the iron trade as it then appeared:

"Judging of the future by the past, the diagram of pig iron production would indicate that the iron trade is now at a pinnacle of prosperity from which there must be a decline in a very short time; but judging from present indications of the actual condition of the trade and of the general prosperous condition of the country, together with the low prices now prevailing, there is not the slightest indication of any decline. The present outlook is one of continued increase in production and in general prosperity."

Within two months after these words were written, the Baring failure took place in England like a bolt from the clear sky, and then began a decline in prices and a depression in the trade which lasted, with a slight intermission during the short boom of 1895, for seven years, continuing through the periods of agitation concerning a lower tariff, the election of President Cleveland, the Wilson bill and the threatened advent of Bryanism. Now, 16 years later the words above quoted again may be applied to the situation, with the exception that high prices, instead of low prices, are now prevailing. Is another bolt from the blue in preparation, and will the history of 1907 repeat that of 1891?

The plotted diagram given herewith shows the course of production and prices of pig iron since 1872, and it shows a curve of the average increase of the rate of production for 42 years, 1864 to 1906. The following table gives the production in these years, in gross tons:

| | |
|---|---|
| 1864 | 1,014,282 |
| 1865 | 831,770 |
| 1866 | 1,205,663 |
| 1867 | 1,305,023 |
| 1868 | 1,431,250 |
| 1869 | 1,711,287 |
| 1870 | 1,665,179 |
| 1871 | 1,706,793 |
| 1872 | 2,548,713 |
| 1873 | 2,560,963 |
| 1874 | 2,401,262 |
| 1875 | 2,023,733 |
| 1876 | 1,868,961 |
| 1877 | 2,066,594 |
| 1878 | 2,301,215 |
| 1879 | 2,741,853 |
| 1880 | 3,835,191 |
| 1881 | 4,141,254 |
| 1882 | 4,623,323 |
| 1883 | 4,595,510 |
| 1884 | 4,097,818 |
| 1885 | 4,044,526 |
| 1886 | 5,683,329 |
| 1887 | 6,417,148 |
| 1888 | 6,489,738 |
| 1889 | 7,603,642 |
| 1890 | 9,202,703 |
| 1891 | 8,279,870 |
| 1892 | 9,157,000 |
| 1893 | 7,124,502 |
| 1894 | 6,657,388 |
| 1895 | 9,446,308 |
| 1896 | 8,623,127 |
| 1897 | 9,652,680 |
| 1898 | 11,773,934 |
| 1899 | 13,620,703 |
| 1900 | 13,789,242 |
| 1901 | 15,878,254 |
| 1902 | 17,821,307 |
| 1903 | 18,009,252 |
| 1904 | 16,497,033 |
| 1905 | 22,992,380 |
| 1906 | 25,300,000 |

The most remarkable fact shown by the figures, and by the average curve, is that notwithstanding panics and depressions of every kind the average rate of increase of the pig iron production for 40 years is more than 100 per cent in every decade. A logarithmic calculation has been made of the average rate of increase per year and per decade for several periods, with the following results.

| Period. | Years. | Rate of increase per year. | Per cent per decade. |
|---|---|---|---|
| 41 years | 1864-1905 | 7.909 | 114.088 |
| 25 years | 1880-1905 | 7.424 | 104.742 |
| 16 years | 1889-1905 | 7.160 | 99.688 |
| 10 years | 1895-1905 | 9.303 | 143.401 |
| 5 years | 1883-1888 | 7.123 | 99.472 |
| 5 years | 1898-1903 | 8.872 | 133.964 |

As far as any one may judge, there is nothing in the future prospects of the iron trade to lead any one to doubt that the production of pig iron will continue to increase for many years to come at about the same rate that it has been increasing on the average for the last 40 years. There may be a decrease in the rate of building of steam railroads, but this is likely to be offset, as far as demand for iron and steel is concerned, by the building of electric railroads. There is likely to be a steadily increasing demand for steel cars, and for steel bars to be used in reinforced concrete.

One lesson to be drawn from the plotted diagram and the average curve is that panics and depressions, while they may set the iron trade back for a few years, are always followed by a period of great activity, as if to make up for the lost time, to replace the rails, cars and other material that have been wearing out during the slack period, and to build the structures, machines, etc., the building of which was postponed during that period. The rate of progress for the 10 years 1895 to 1905, 9.303 per cent per annum, or 143.401 per cent per decade, was no doubt due to some extent to making up for the lost time of the years 1890 to 1895, and it does not seem reason-

able to suppose that that rate of progress will continue for many years, but we have good reason for believing that the rate for 25 years, 1880 to 1905, which included one big panic period and two small ones, will continue for a long time to come. Using the rate of these years, 7.424 per cent per annum, or 104.742 per cent per decade, we have the following figures for the prospective production up to 1920, in round numbers:

| | Gross tons. |
|---|---|
| 1905 | 22,990,000 |
| 1906 | 24,700,000 |
| 1907 | 26,530,000 |
| 1908 | 28,510,000 |
| 1909 | 30,620,000 |
| 1910 | 32,900,000 |
| 1911 | 35,340,000 |
| 1912 | 37,960,000 |
| 1913 | 40,780,000 |
| 1914 | 43,810,000 |
| 1915 | 47,070,000 |
| 1916 | 50,560,000 |
| 1917 | 54,320,000 |
| 1918 | 58,350,000 |
| 1919 | 62,680,000 |
| 1920 | 67,340,000 |

Assuming that the rate per decade should decrease to 100 per cent after 1910, we have the following possible figures for the next 40 years.

| | |
|---|---|
| 1910 | 33,000,000 |
| 1920 | 66,000,000 |
| 1930 | 132,000,000 |
| 1940 | 264,000,000 |
| 1950 | 528,000,000 |

The concluding figure is a startling one, but who can say it is not possible? It is not more astonishing than the increase from 1,000,000 to 25,000,000 tons in the last 42 years.

## RAILROAD EARNINGS.

The compilation made by the *Financial Chronicle* of the gross and net earnings of United States railroads for the month of October makes on the whole a quite satisfactory showing. In the gross earnings there is an improvement of $14,842,203, or 11.55 per cent, in the net earnings an improvement of $4,858,869, or 10.38 per cent. The tendency of operating costs to increase is reflected in the large augmentation in expenses—$9,983,334, or 12.22 per cent—and in fact that the ratio of gain in net has been smaller than the ratio of gain in the gross.

In a statement given out for publication J. J. Hill has denied that he intends to retire from the presidency of the Great Northern railroad on July 1, as stated in press dispatches. President Hill states that however much he would like to be relieved of the responsibilities of his position, he cannot see his way clear to do so at this time.

## THE TESTING OF INFLAMMABLE GASES.[1]

By C. E. Sargent.[2]

With the increasing demand for internal combustion engines, the great activity in by-product and producer plants, and the vigorous growth of gas industries, the testing of gases for their calorific value and foreign ingredients is one of the duties of the engineer, and a simple, quick and efficient method of making such determinations greatly facilitates his work. In making efficiency tests of gas engines and in determining the solid matter, moisture, and calorific value of gases, methods have been used and apparatus designed by the writer which give uniform and rational results heretofore obtained through more tedious operations.

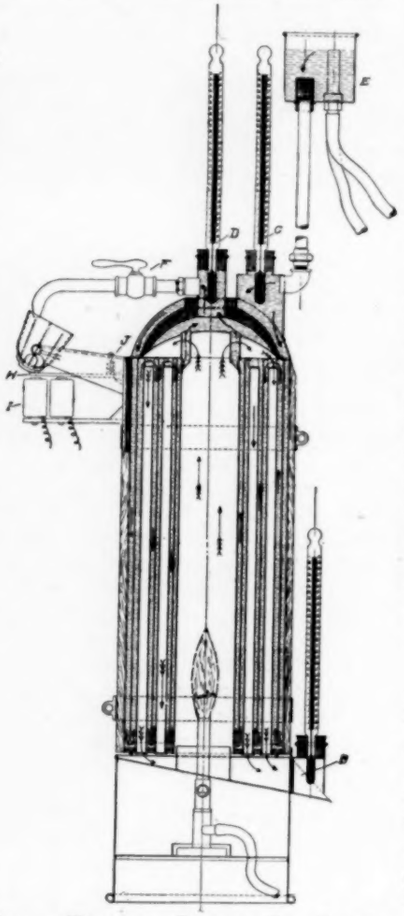


Fig. 1.—Detail of Sargent Gas Calorimeter.

In order to determine the heating value of a gas it is necessary to utilize all the heat of combustion in doing tangible work which can be measured without error or loss. The heat of combustion of a measured quantity of gas is used to raise the temperature of water; and the quantity of water, the rise in temperature, and the volume of gas are the three factors necessary to get its calorific value. To prevent a possible error of radiation, the temperature of the gas, surrounding air, inlet water, and exhaust products, should be practically the same; then if the loss of heat by radiation from the water whose temperature is rising is obviated, reasonable results are possible.

In the apparatus used by the writer, the inlet water, the temperature of which should be pracically that of the surrounding air, envelops the whole calorimeter, thereby carrying in the heat which it might absorb from the water whose temperature is rising. Fig. 1 shows a section of a calorimeter in which the inlet water, having a constant head at the cistern E, the temperature of which is taken at C, the direction of the arrows, and the rise in temperature is taken by the thermometer at D before any heat is lost by radiation to the air. The combustion of gas takes place in the central flue and the products of combustion pass to the top and down the annular chambers, reaching the temperature of the water before passing out at B, where a damper regulates the velocity and the thermometer gives the temperature of the exhaust products.

The calorimeter should be operated in a closed room free from air currents which disturb the equilibrium and vitiate results. Even with the most perfect conditons, errors from observation or conversion are possible. When B. T. U. are desired, as is the case in most English speaking countries, and centigrade thermomeers are used, mistakes are sometimes made in transformation. As a degree Fahrenheit is five-ninths of a degree centigrade, when both are divided into tenths, the Fahrenheit thermometer will give nearly twice as close a reading as the centigrade instrument.

When the outlet water is measured in graduated beakers, it must be changed from cubic centimeters to pounds. The varying meniscus, the possibility of the beakers being out of level, and the temperature of the water are elements of error possible when the outlet water is measured. By weighing the discharged water and using Fahrenheit thermometers, no transformation from cubic centimeters to grams, from centigrade to Fahrenheit, or from calories to B. T. U. are necessary. Readings are direct

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in B. T. U. and errors of transformation and the mysteries of metric measurements are entirely eliminated.

One of the greatest errors in determining the calorific value of a gas arises when the operator attempts to switch the outlet water from one receptacle to another after a certain quantity of gas has been burned. To eliminate this "personal error" the automatic dumping bucket, shown in Figs. 1 and 2, was designed This bucket is held in position by the keeper H and spring J. The weight of the water on the full side tends to oscillate the bucket so that the water will flow into the empty side and through another outlet to the empty receptacle. When the test meter needle passes the zero point (behind the binding post, Fig. 2) an electrical circuit is completed, which, passing through the solenoid, Fig. 1, draws down the keeper H and allows the outlet water to automatically change from the full to the empty pail, Fig. 2.

With such a device the personal error is not only eliminated but much of the work of the operator is done automatically, thereby allowing him more time for observing the temperatures and weighing the water delivered. By switching the water for every tenth of a cubic foot of gas burned, observations are taken about every four minutes and the calorific value can be determined for the preceding test before the meter needle completes its next rotation. In this way a test may continue without intermission as long as the engine is in operation, or the producer is furnishing gas.

Since producer gas with a varying feed and output and natural gases coming from different wells, are often mixed with illuminating or water gas to keep up the pressure where the demand in large cities during zero weather exceeds the supply, the illuminating gases may vary in calorific value during the conditions of manufacture. Therefore, short runs but continuous determinations are necessary for satisfactory and rational results.

If the thermal efficiency of an engine is desired, the calorific value of the meter gas only is necessary, but for the sake of comparison, the B. T. U. are usually given in cubic feet of standard gas. The book of tables compiled by Prof. McFarland, member of the society, enables the operator to change meter gas to standard gas, merely by knowing the temperature, pressure, and barometer readings. With Fahrenheit thermometers, scales weighing to hundredths of a pound, tables reducing meter gas to standard gas, and automatic devices not only to do a great deal of the operator's work but to eliminate the error which necessarily arises under hand manipulation, the determination of the heat units of any gas by the calorimeter becomes a simple matter.

In testing producer gas below atmospheric pressure it is necessary to raise the pressure with a water ejector, but as this may add more or less water to the gas, the pressure is preferably raised with an electric or hydraulic driven centrifugal fan, as no moisture is added to the gas by this method. When testing gas has been washed and dried to determine the efficiency of the drier, the gas is passed through a condenser to reduce its temperature, or through calcium chloride bottles to absorb the moisture, or through both, as the conditons demand. By weighing the bottles and the calcium before and after and knowing the cubic feet of gas, the percentage of moisture is readily obtained.

When the efficiency of the gas washers is required, i. e., the grains of dust per cubic foot in the washed gas, at the same time the calorific value is determined, the gas is passed through a filter paper, the holder of which is shown in section in Fig. 3, which retains every particle of dust, as is proved by letting the gas pass through two filter papers in series, the second of which remains white and does not increase in weight.

When gas is tested for dust and moisture only, a self-contained outfit, Fig. 4, provides for continuous determinations. The gas passes through a filter, condenser, calcium chlorid bottles, and test meter, and while the accumulations of dust on one filter paper are being weighed, gas is passing through the other. In this way a continuous record of the dust in blast furnace gas is determined and the efficiencies of the working apparatus maintained.

The calorimeter complete, as used by the author, consists of a test meter, which reads in cubic feet—one revolution of the pointer of which measures one-tenth of a cubic foot—gas thermometer, pressure gauge, one pressure regulator with micrometer adjustment, one Bunsen burner, and one calorimeter proper with inlet, outlet, and exhaust products, thermometers graduated in tenth of degrees Fahrenheit, automatic dumping bucket, dry batteries, balanced copper pails, and decimal platform scales. When gas is tested for solid matter at the same time its calorific value is determined, the tar, moisture, and dust extractors as shown on the right are used. As the products of combustion are saturated, the gas and air should be saturated if the net amount of hydrogen in the gas is desired. In determining the calorific value of metered gas, no corrections for pressure and temperature are made.

As the temperature of the gas, air,

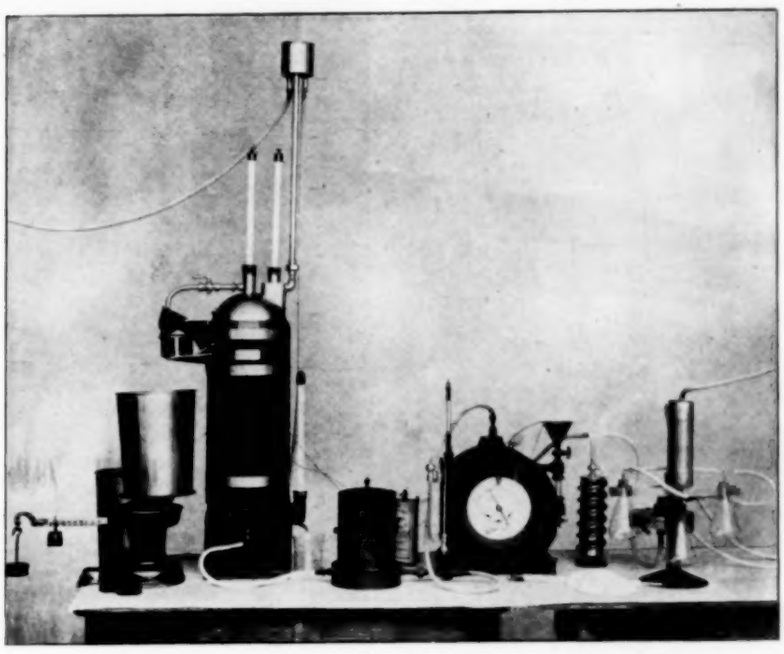

FIG. 2.—EXTERIOR VIEW OF SARGENT GAS CALORIMETER.

and exhaust products should be practically constant and as these temperatures are not used in the calculations, a record for each reading is seldom taken. Often these temperatures are noted only under remarks or at the beginning of the log, which simplifies the work and allows room for reducing the metered gas to standard gas during the observations.

From the barometer readings, 28.854 we add 0.037, the pressure of ½ inch water in mercury, making the absolute pressure of the gas, 28.9 and, from the tables above referred to for gas of 30 inch Hg. and 62 degrees Fahr. we find the constant to be 0.9704, which multiplied by the B. T. U. of metered gas gives the B. T. U. of standard gas.

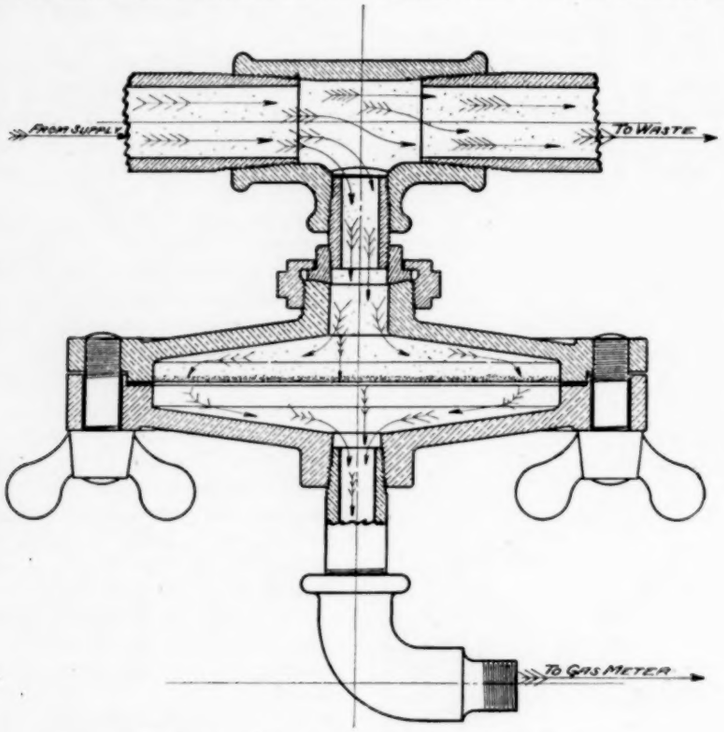


FIG. 3.—DETAIL OF FLOOR IN GAS CALORIMETER.

The B. T. U. obtained are the total or high value of the gas. As the exhaust products of a gas engine are hotter than boiling water and the products of combustion of the hydrogen and oxygen are in the form of steam, the latent heat of the steam in products of combustion must be subtracted from the total B. T. U. to get the low or available value. As the latent heat of steam is 966.6 B. T. U. per pound and as the condensed water which is cooled down to the temperature of the exhaust products absorbs this additional amount of heat, the available heat in the gas equals the difference between the high value and the B. T. U. represented by the pounds of steam condensed times the latent heat of steam plus the difference between 212 degrees and the temperature of the exhaust products.

As soon as the dripping of the water coming out with the products of combustion is uniform, the test for the low value can be started and run while the high value is being obtained. From one to three feet of gas are burned before the condensed water is weighed and the difference between the high and low value is ascertained. If during these determinations of the heating value of a gas showing an average of 960 B. T. U. per cubic foot, three cubic feet of gas are burned and there is collected 0.15 pound of water, and the temperature of the exhaust gases is 60 degrees Fahr., the hydrogen products would be (9666.6 + (212 —60) 152 x 0.15= 55.9 B. T. U., which subtracted from the high value (960 — 55.9) gives 904.1 B. T. U., the available heat in the gas when used in an engine whose exhaust is hotter than 212 degrees Fahr.

The percentage of dust per cubic foot is determined in like manner. The filter paper is dried and weighed and after several feet of gas have passed through, it is again dried and weighed and the grains per cubic foot are determined.

In conclusion, the author finds that the analysis of gases for their B. T. U., dust and moisture is greatly facilitated:

(a) By enveloping the water whose temperature is rising with the inlet water to prevent radiation. (b) By using Fahrenheit thermometers graduated in tenth degrees. (c) By making frequent but continuous determinations when testing gases whose calorific value varies. (d) By having the water automatically switched from one receptacle to another when a tenth of a foot of gas is burned. (e) By weighing the heated water on decimal scales in balanced buckets rather than measuring it in graduated beakers. (f) By using filter papers to strain out the dust in preference to cotton filled tubes.

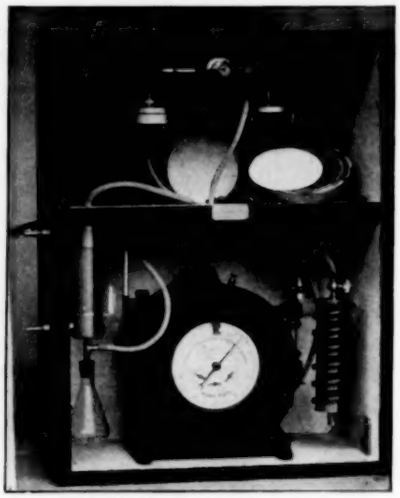

FIG. 4.—EXTERIOR VIEW OF SARGENT DUST DETERMINATOR.

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Announcement has been made at Marion, O., that the Ohio & Western Lime & Stone Co., incorporated at $1,500,000, has purchased the properties and rights of the Norris & Christian Lime & Stone Co., the Central Ohio Lime & Stone Co., and John D. Owens & Son, three of Marion county's leading lime and stone concerns. It is stated that an effort is under way to merge all Ohio lime and stone enterprises into an Indiana corporation.

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A shipment of coal direct from Pittsburg to Havana, Cuba, will be made by the Pittsburg Coal Co., early in 1907. Special steel barges have been constructed for the ocean trip. The shipment is an experimental one and if successful, the company will continue transporting coal direct to Cuba.

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A loss of several hundred dollars was caused by a small fire in the foundry department of the Atlas Mfg. Co., Fostoria, O., Dec. 28.

# Improved Money Rates Stimulate Trade.

The prediction that the new year would bring a resumption of the bull movement was not wholly fulfilled by the trading of the first week in 1907. However, money rates showed a decided easing and in this respect at least the market forecasters, who had predicted such a situation, were borne out. The week opened with a desultory and insignificant trading which continued throughout the first few days. A general improvement followed when the relaxation of money rates became apparent. Friday witnessed a general rally, and it was significant that this came immediately after the interstate commerce commission had begun its probe of the Harriman railroad system. Gossip on the street had it that the Harriman and allied interests were factors in the bull movement. Many investors were watching for such an upward tendency in the market and the movement gained a fair following. Maximum call money rates on Monday, the last day of 1906, were 45 per cent; on Friday, of the past week, the day of general rallying in the market, the daily maximum dropped to 6 per cent. The highest call rate of the present year so far has been 20 per cent, showing a decided improvement over the last week of 1906, when the maximum was 60 per cent. Time money eased in proportion to call money. Improvement in the money market has led to many optimistic prediction on the future. Some of these are probably over-enthusiastic. A dull stock market speculation has been one of the factors in easing of money rates, a decided contrast over the opening week of last year, when every day brought forth transactions reaching over 1,000,000 shares. A gain of six points by Cambria Steel was one of the features of the market, and followed the report that that corporation and the Pennsylvania Steel Co., controlled by Pennsylvania railroad interests, were to be merged. United States Steel was fairly active, 317,200 shares common changing hands, with an advance of about 1¾ points, and 20,500 shares of preferred were sold with a rise of 1⅝ points. Republic Iron & Steel was active; the 16,400 shares common, which were sold, showed a rise of 1⅞, and the 1,300 shares preferred showed a gain of 1⅝. In American Car & Foundry the sale of 13,800 common showed a gain of 1⅝.

The American Car & Foundry Co., shows a gain in net earnings of $1,062,243 for the quarter ending Oct. 31, 1906. The figures for this quarter were $1,779,982 in 1906 and $717,739 in 1905, respectively.

The annual report of the Pope Mfg. Co. for the fiscal year ending Jan. 31, 1906, shows net earnings of $1,293,613 in '05-'06, as compared with $1,304,749 in '04-'05, and $1,230,796 in '03-'04.

A special meeting of the stockholders of the Hall Signal Co. has been called for Jan. 15 at Portland, Me., to vote upon a proposition to issue $1,000,000 additional preferred stock for improvements made necessary by increased business.

Recent dividend declarations include a 2 per cent quarterly dividend and a special stock dividend of 8 per cent by the La Belle Iron Works, of Wheeling, W. Va.; a semi-annual dividend of $2 a share by the Allegheny Bridge Co.; an increase in the annual dividend rate from 5 to 6 per cent by the Youngstown Sheet & Tube Co.; the regular quarterly dividend of 1¾ per cent on preferred stock and a dividend of 4½ per cent on common stock by the Montreal Steel Works, Ltd., and the regular quarterly dividend of 1 per cent by the Chicago Pneumatic Tool Co.

According to Bradstreets there were 9,384 failures in the United States for the calendar year 1906, a decrease of 6 per cent over 1905, the smallest total of failures reported by that firm in any year since 1882. A few large bank suspensions swelled the liabilities to $123,827,957, an increase of 1.6 per cent over 1905.

## THE LEADING INDUSTRIAL SECURITIES.

| | Closing Quo. Jan. 5 | Changes In Week | Date 1907 Ann. Meet. | Stock Outstanding | Dividend Basis | Dividend Being Paid | Dividend Date Last Div. Pay. |
|---|---|---|---|---|---|---|---|
| Allis-Chalmers | 16⅞ | + ⅛ | Sept. 5 | 19,820,000 | | ..... | ..... |
| Allis-Chalmers pr | 42¾ | — 2 | | 16,150,000 | 7 cum | ..... | Feb., 1904 |
| American Can | 5⅝ | .... | Feb 5 | 41,233,300 | | ..... | ..... |
| Am. Can pr | 54 | ..... | | 41,233,300 | 7 cum | 5 Q. | Jan., 1907 |
| Am. Car and Fdy | 44⅝ | +1⅝ | June 27 | 30,000,000 | | ½ Q. | Jan., 1907 |
| Am. Car and Fdy pr | 101⅝ | + ⅝ | | 30,000,000 | 7 n. c. | 7 Q. | Jan., 1907 |
| American Loc | 74 | +1⅝ | Oct. 5 | 25,000,000 | | 1¾ | Feb., 1907 |
| American Loc. pr | 109½ | + 1 | | 24,100,000 | 7 cum | 7 Q. | Jan., 1907 |
| American Ship | 76¾ | +1¾ | Oct. 2 | 7,600,000 | 6 | 1 Q. | Dec. 1906 |
| American Ship. pr | 109 | ..... | | 7,900,000 | 7 n. c. | 1¾ Q. | Jan. 1907 |
| Am. Steel Foundries | 10⅛ | — ⅜ | Oct. 1 | 15 810,000 | | ..... | ..... |
| Am. Steel Foundries pr. | 47 | +1⅛ | | 17.240,000 | 6 cum | ..... | Aug., 1904 |
| Barney & Smith | 70 | .... | June 4 | 2,000,000 | 4 | 4 | Dec., 1906 |
| Barney & Smith pr | 140 | ..... | | 2,500,000 | 8 cum | 8 Q. | Dec., 1906 |
| Bethlehem Steel | 19 | ..... | April 2 | 14 862,000 | | ..... | ..... |
| Bethlehem Steel pr | 60 | ..... | | 14,908,000 | 7 n. c. | 3 Q. | Nov ,1906 |
| Cambria Steel | 43⅝ | + 6 | Mar. 19 | 45,000,000* | 6 | 3 Q. | Aug., 1906 |
| Cambria Iron | 47½ | ..... | | 8,468,000* | 4 | 4 S. A. | Oct., 1906 |
| Chicago Pneumatic Tool | 50 | + ½ | Feb. 18 | 6,145,800 | 4 | 4 Q. | Jan., 1907 |
| Colorado Fuel | 55⅛ | +1⅜ | Oct. 21 | 30,132,000 | | ..... | Apr., 1902 |
| Crucible Steel | 12¾ | + 1 | Oct. 16 | 24,578,400 | | ..... | ..... |
| Crucible Steel pr | 79 | +2¼ | | 24,436,500 | 7 cum | 6 | Dec., 1906 |
| Empire Steel | 7 | + 1 | Feb. 27 | 2,281,400 | | ..... | ..... |
| Empire Steel pr | 47 | — 3 | | 2,500,000 | 6 cum | 3 S. A. | July, 1906 |
| Fay & Egan | 95 | — 5 | Feb. 19 | 1,000,000 | 6 | 6 Q. | Nov., 1906 |
| Fay & Egan pr | 128½ | ..... | | 1,000,000 | 7 cum | 7 Q. | Nov., 1906 |
| General Electric | 160½ | + ¼ | May 14 | 51,356,000 | 8 | 8 Q. | Jan., 1907 |
| Harbison-Walker | 13¾ | ..... | Jan. 21 | 18,000,000 | 6 | ..... | ..... |
| Harbison-Walker pr | 79¾ | — ⅛ | | 9,600,000 | 6 cum | 6 Q. | Jan., 1907 |
| International Pump | 40 | +1⅝ | June 4 | 17,762,500 | | 2 | Apr., 1905 |
| International Pump pr | 80¾ | — ⅛ | | 11,850,000 | 6 cum | 6 Q. | Nov., 1906 |
| Lackawanna Steel | 71 | ..... | Mar. 13 | 34,971,400 | | ..... | ..... |
| Lake Sup. Corp. | 14 | ..... | Oct. 2 | 40,000,000 | | ..... | ..... |
| New York Air Brake | 138¾ | + 1 | June 18 | 10,000,000 | 8 | 8 Q. | Jan., 1907 |
| Niles-Bement-Pond | 130 | .... | Feb. 6 | 5,000,000 | 6 | 6 Q. | Sept. 1906 |
| Niles-Bement-Pond pr | 105 | ..... | | 2,000,000 | 6 cum | 6 Q. | Dec., 1906 |
| Otis Elevator Co. | 50 | ..... | March 18 | 6,350,300 | | 2 A. | Apr., 1906 |
| Otis Elevator Co. pr | 94 | — 2 | | 6.308,500 | 6 n. c. | 6 Q. | Jan., 1907 |
| Penn. Steel | 60 | ..... | May 13 | 10,750,000 | | ..... | ..... |
| Penn. Steel pr | 104 | ..... | | 16,500,000 | 7 n. c. | 7 S. A. | Nov., 1906 |
| Pittsburg Coal Co | 16½ | — ⅛ | Feb. 11 | 29,045,400 | | ..... | ..... |
| Pittsburg Coal pr | 60⅝ | +2⅜ | | 30,217,700 | 7 | ..... | Apr., 1905 |
| Pressed Stl Car | 57⅛ | +3⅜ | Feb. 20 | 12,500,000 | | 3 | Aug., 1904 |
| Pressed Stl. Car pr | 98½ | — ⅛ | | 12,500,000 | 7 n. c. | 7 Q. | Nov., 1906 |
| Pullman | 180⅜ | + ⅛ | Oct. 17 | 100,000,000 | 8 | 8 Q. | Oct., 1906 |
| Railway Stl. Spring | 55 | + 2 | Mar. 7 | 13,500,000 | | 4 S. A. | Oct., 1906 |
| Railway Stl Spring pr | 98½ | ..... | | 13,500,000 | 7 cum | 7 Q. | Dec. 1906 |
| Rep. Iron & Steel | 40⅜ | +1⅜ | Oct. 9 | 27,191,000 | | ..... | ..... |
| Rep. Iron & Steel pr | 98⅜ | +1⅜ | | 20.416 900 | 7 cum | 7 Q. | Jan., 1907 |
| Sloss-Sheffield | 76⅛ | +2¼ | Mar. 5 | 10,000,000 | 5 | 5 S. A. | Oct., 1906 |
| Sloss-Sheffield pr | 102 | — 3 | | 6.700,000 | 7 n. c. | 7 Q. | Jan , 1907 |
| Tenn Coal & Iron | 161½ | +1½ | May | 22.553,600 | 4 | 4 Q. | Nov., 1906 |
| U. S. Pipe & Fdy | 48⅜ | +2¼ | June 26 | 12,500,000 | 4 | 4 Q. | Dec., 1906 |
| U. S. Pipe & Fdy. pr | 87⅛ | +2½ | | 12,500,000 | 7 n. c. | 7 Q. | Dec., 1906 |
| U. S. Steel | 49⅜ | +1¾ | April 15 | 508,302,500 | 2 n c | ½ Q. | Oct., 1906 |
| U. S. Steel pr | 108⅜ | +1⅝ | | 360,281,100 | 7 cum | 7 Q. | Nov., 1906 |
| U. S. Steel 5's | 98⅜ | + ¼ | | 463,798,000 | 5 | 5 A. | ..... ..... |
| Va. Iron. Coal & Coke | 83 | +3½ | Sept. 17 | 8,641,600 | | ..... | ..... |
| Westinghouse Elec | 154 | + 3 | June 26 | 20.996.350* | 10 | 10 Q. | Jan., 1907 |
| West'ghouse Air Brake | 154½ | —2½ | Oct. 1 | 11.000 000* | | 22½ Q. | Jan. 1907 |

Par value of shares, $100, except those starred, $50.

# NEWS FROM MANY INDUSTRIES.

**New Buyers:—**

The Wood Turret Machine Co., Terre Haute, Ind., has been organized with a capitalization of $20,000 by J. W. Wood, William B. Hice and D. W. Wood.

The Maynard Steel Foundry Co., Milwaukee, Wis., has been incorporated with a capital of $6,000 by C. F. Maynard, W. T. Maynard and M. B. Maynard.

The Southern Foundry & Machine Co., Norfolk, Va., has been incorporated with a capital of $10,000 by R. A. Waighwright, C. M. Tunstall and T. D. Savage.

The Kindling Machinery Co., Milwaukee, Wis., has been incorporated with a capital of $50,000 by Louis Kindling, James T. Bannen and Lawrence A. Olwell.

The Meredith Construction Co., Terre Haute, Ind., has been organized with a capitalization of $20,000 by Fred C. Meredith, Paul J. Meredith and Lawrence M. Staff.

Albert Smith & Son, New York, have been organized with a capitalization of $10,000 by Albert Smith, John A. Smith and Edwin Smith, 687 Eleventh avenue, New York.

The Allyne Brass Foundry Co., Buffalo, N. Y., has been organized with a capitalization of $50,000 by George C. Niler, Henry C. Coester and Charles A. White, all of the above address.

The National Mill & Mfg. Co., Muskogee, I. T., has been organized with a capitalization of $25,000 by J. T. Haislip, E. L. Bazwell, A. E. Davidge, Alexander Richmond and Leander Hall.

The Model Machine Works, Frankfort, Ind., has been incorporated to operate a machine shop. The capital stock is $10,000, and the incorporators are: Joseph P. Palmer, C. H. Hillis, A. A. Laird and P. F. Gable.

The Frank J. Dyetl Co., Utica, N. Y., has been incorporated to manufacture engines, boilers, etc. The capital stock is $15,000 and the incorporators are: Frank J. Dyetl, George Dyetl and Caroline B. Dyetl.

The Walden Mfg. Co., Worcester, Mass., has been incorporated to deal in wrenches and other mechanical tools. The capital stock is $20,000, and the incorporators are: Frederick E. Walden and Charles A. Shedd.

The J. C. Armstrong Machine Co., has been incorporated with a capital of $40,000 by J. C. Armstrong, Clarissa Armstrong and Elizabeth Banvard. The plant of the company is located at 103 South Washington street, Peoria, Ill.

Hauser, Weidner & Co., Rochester, N. Y., has been incorporated to manufacture engines, boilers and heavy hardware. The capital stock is $90,000, and the incorporators are: Henry J. Hauser, Carl A. Weidner and John C. Eiseman.

The Estes Machine Co., Nashville, Tenn., has been incorporated to manufacture wood-working machinery, such as saws and sawmills. The capital stock is $5,000, and the incorporators are: F. L. Estes, W. H. Frickling, Frank Rives and E. S. Wright.

The Birch River Coal & Coke Co., Cowen, W. Va., has been incorporated with a capital of $100,000 to develop coal and timber lands. The incorporators are: C. B. Couch, J. M. Connihay, E. A. Reid, A. S. Alexander and Murray Briggs, all of Charleston, W. Va.

The Summit Coal & Coke Co., Clarksburg, W. Va., has been organized with a capitalization of $50,000 by H. R. Miller, H. A. Gilbansky, of Pittsburg, Pa.; Frederick Brandt, of Detroit, Mich.; Thomas P. Richey, of Allegheny, Pa., and Robert D. McKeon, of Columbus, O.

The E. J. O'Brien Mfg. Co., St. Louis, Mo., has been incorporated to manufacture and deal in machinery, etc. The capital stock is $100,000, and the incorporators are: E. O'Brien, Frank E. Palmer, John Dell, all of St. Louis, and John W. Faesler and John C. O'Keefe, of Moberly, Mo.

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**New Construction:—**

The Peninsular Motor Co., Grand Rapids, Mich., is planning a new foundry, 50 x 118 feet.

The Swedish Iron Co., Cheswick, Pa., is contemplating the erection of a sheet steel rolling mill to employ 400 men.

The new stack of the Haselton group of the Republic Iron & Steel Co., near Youngstown, was put in blast Jan. 1.

The Illinois Iron & Bolt Co., Chattanooga, Tenn., will erect a plant to cost about $400,000 on a site recently purchased near that city.

The Des Moines Bridge & Iron Co., Des Moines, Ia., has begun the erection of a large addition to its plant which will double its output.

Work has been begun on the new power house, 20 x 45 feet, which the P. & F. Corbin Co., manufacturer of hardware, New Britain, Conn., is building.

The Harrington Package Co., Crandon, Wis., has completed its main building, 55 x 205 feet, and is now ready for the installation of machinery.

The Tower Mfg. Co., operated by the W. F. Robertson Steel & Iron Co., of Cincinnati, is in the market for rivet headers to increase the capacity of its plant.

Plans have been drawn for a five story brick addition, 50 x 60 feet, by the Stanley Works, New Britain, Conn., manufacturer of iron butts, bolts and hinges.

The Landers, Frary & Clark Co., New Britain, Conn., has contracted for a new annealing shop, one story, 30 x 50 feet. An addition 37 feet square will be made to the die vault.

The Monarch Tool Co., recently incorporated at Stamford, Conn., will erect a new structure 40 x 80 feet, two stories high, at Springdale. E. Everett Rowell, of Stamford, is president of the company.

A new stock company known as the Baugh Foundry Co. is being organized at Alliance, O., to take over the present foundry of Frederick Baugh and to erect a modern plant in that city.

Municipal permits for the erection of two additional factories, 103 x 110 feet, and 110 x 118 feet, to be used as rod mills have been taken out by the Waterbury Brass Co., Waterbury, Conn.

Contractors are figuring on plans for the new factory to be erected by the Winchester Arms Repeating Co., at New Haven, Conn. A large amount of iron and copper work will be required.

A cement plant to cost $2,400,000 will be erected either at Colville, Wash., or Pend d'Oreille Lake, Idaho. J. P. Spear, manager of the Washington Brick, Lime & Mfg. Co., and others, are interested.

The Southern Implement Co., Ltd., Jennings, La., recently incorporated, has taken over the business of the Calcasieu Implement Co., and, it is reported, will erect a two-story brick building, 80 x 110 feet.

The Moore Drop Forge Co., Springfield, Mass., expects to put in commission for a drop shop the new steel building which it is now erecting. A. L. Moore is president of the company, and A. H. Chapin, treasurer.

The Milwaukee Refrigerator Transit Co., Milwaukee, Wis., has purchased land just north of that city, and is arranging for the erection of its own car shops, to cost $50,000. The company will also erect cottages for its employes.

The John J. Bruce Foundry Co., Cincinnati, recently incorporated, is looking for a suitable location upon which to erect a new plant. In the meantime the company will operate its present works. John J. Bruce is president of the company.

The new buildings of the Northway Motor & Mfg. Co., Detroit, Mich., when completed, will be 60 x 200 feet for the main structure and 50 x 90 feet for the side buildings. The entire equipment for the plant has been purchased and most of it installed.

The Robb Engineering Co., Ltd., Amherst, N. S., whose office building was recently destroyed by fire, expects to rebuild in the spring. Other extensions are planned. E. W. Robb, is president of the company; G. W. Cole, secretary-treasurer and A. G. Robb, superintendent.

A concrete building with stone foundation 90 x 170 feet, one story high, will be built at Worcester, Mass., by J. E. Snyder & Son, builders of upright drills. The company has already purchased a site. A traveling crane will be installed along with other machinery which has already been purchased.

The Indiana Foundry Co., Ltd., Indiana, Pa., will install additional equipment, consisting of two lathes, a large drill and a pipe machine, all tools to be driven by a 20-horsepower gas engine, in the new cement machine shop, 40 x 140 feet, which is now under way. The foundry will also be enlarged when the machine shop has been completed and equipped.

The Kern Machine Tool Co., Cincinnati, recently incorporated for $50,000, has about completed the construction of its building. Most of the equipment has been purchased. The company has bought the upright drill business of the American Tool Works Co. The officers are: Clifford F. Kern, president, and Philip Fosdick, vice president.

The American Cylinder Brace & Tool Mfg. Co., recently organized at West Palm Beach, Fla., with a capitalization of $10,000, has secured a tract of land for the location of its plant, and is making arrangements for the erection of necessary buildings. William Heim, of West Palm Beach, Fla., is president of the company, and M. E. Spence, secretary and treasurer.

The Sandusky Foundry & Machine Co., Sandusky, O., has increased its capital stock from $50,000 to $100,000, and has taken over the plant of the Co-operative Foundry & Machine Co., of that city, now in the hands of a receiver. New machinery will be installed in the foundry and machine shop. W. H. Millspaugh is president, Sidney Frohman, secretary, and J. J. Dauch, treasurer.

The Connecticut Computing Machine Co., New Haven, Conn., recently incorporated for $600,000 to manufacture a mechanical mathematician, is having plans drawn for a new brick building 50 x 150 feet, five stories high. The investment is subject to the decision of the stockholders at a meeting in January. It is also contemplated to erect smaller structures, such as engine house, boiler house, etc. The officers of the company are: Rollin S. Woodruff, president; Charles M. Jarvis, of New Britain, vice president; Edward S. Swift, of New Haven, secretary; Frederick M. Carroll, assistant secretary, and William R. Tyler, treasurer.

An addition to the manufacturing capacity of the Brown-Talbot Machine Co., Salem, Mass., is to be made. Three new buildings will be erected, one 40 x 64 feet, one story, another 24 x 32 feet, two stories, and a third 18 x 24 feet, one story. It is reported that the company will require some new machine tool equipment.

The Washburn Co., Minneapolis, Minn., manufacturing railroad and general steel castings, on account of its rapidly growing business will make additions which will materially increase the output of its plant. A new foundry building 60 x 400 will be built, and one 20-ton basic open-hearth furnace and one 15-ton acid furnace will be installed. The plant will be operated by electricity and will have a complete air equipment throughout. Work will be started about April 1, and contracts for the building and equipment will be be awarded in February or March.

The new shop which J. E. Snyder & Son, Worcester, Mass., are to erect at the corner of Parker and Dewey streets, in that city, will be of reinforced concrete, 90 x 170 feet, one story. The contract for the building has been let, and preliminary work of excavation has begun. New machine tools have already been ordered, and it is expected that the present working force of 40 men will be doubled as soon as the company is in its new shop.

Plans are being considered for an extension to the plant of the Indiana Brass & Foundry Co., at Marion, O.

The Merrimac Chemical Works, of Woburn, Mass., is planning to increase the capacity and equipment of its plant in the near future.

Dr. Frederick J. Wearne, proprietor of the Wearne foundry, of Omaha, Neb., will erect a three-story brick foundry building, in the spring, for his present plant.

The Lumsden & Van Stone Co., 69 High street, Boston, states that work on the new $100,000 machine shop, to be built by it in that city, will not be started until spring. A large foundry building, a machine shop, a brass turning shop and a storehouse for patterns are projected.

An addition, 76 x 90 feet, is being erected by the Owensboro Shovel & Tool Co., Owensboro, Ky., which will be devoted to the manufacture of handled hoes. Practically all of the machinery required has been ordered. The company hopes to be turning out handles and handled hoes in the early spring.

The Irondale furnace, Irondale, Wash., is enlarging its stack, preparatory to starting up again. A new battery of boilers of 350 horsepower will be erected. It is the intention of the company to build a plant for the manufacture of cement from furnace slag. The product of the furnace will be largely foundry pig iron, but it will also be able to produce low-phosphorus Bessemer as well as basic pig. The capacity will be about 70 tons a day. William Price is superintendent of the furnace plant.

The Gardner Valve Mfg. Co., New York, has plans under way for a plant to be erected at Hampton Junction, N. J. It is the intention of the company to install a 100-horsepower high-speed engine to be directly connected to a generator, and 25 or 30 motors will be purchased for driving machinery. The plant will consist of a one-story iron foundry, 70 x 200 feet, a two-story brass foundry, 42 x 50 feet, and a two-story machine shop, 72 x 150 feet. All the machinery arrangements will be made from the company's plant at 95 Liberty street.

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**General Industrial Notes:—**

The Pennsylvania Steel Co. is expected to start its new blast furnace at Chester, Pa., in a few days.

The Sharon, Pa., furnace of the Republic Iron & Steel Co., after a long shut down for improvements, has been blown in.

The Barker Mail Crane Co., of Clinton, Ia., states that it will not

erect any building or buy any machinery at present.

The Marion Threshing Machine Co., Marion, O., has filed a bankruptcy petition, scheduling liabilities of $210,000 and assets of $400,000.

W. V. Kelley, president of the American Steel Foundries, has purchased the Central Union building, at Madison and Market streets, Chicago, valued at $510,000.

The Norwalk Steel & Iron Co., which was recently reincorporated, took this action in order to operate hereafter under the laws of Ohio, instead of Delaware.

The new plant of the Graham-Philips Horseshoe Co., at Hooven, near Cincinnati, has been placed in operation. H. Lee Early, of Cincinnati, is interested in it.

The Ohio Pulley Co., Cuba, N. Y., has taken over the business formerly conducted by the Ohio Pulley Co., of Marion, O. The Buckeye wood split pulleys will be manufactured.

The Pittsburg Bridge & Iron Co., Rochester, Pa., has leased the seventh floor of the Hartje building in Pittsburg, and will move its entire office equipment to the new quarters.

Beaudry & Co., Boston, recently incorporated, have taken over the old established business of Beaudry & Co., manufacturers of the Champion power hammer and other forging machinery.

The Putnam Tool Co., Fitchburg, Mass., has sold its factory to the Stratton Rotating Engine Co., Providence, R. I., which will occupy the plant with a view to enlargement next summer.

The Girard Hardware Co., Girard, Pa., has taken over the general hardware business of Easterbrooks & Co. No equipment will be purchased at present. J. P. Sherman is treasurer of the company.

Because of the firm's inability to deliver steel plates sold for forward delivery, the suspension of Neilson Brothers & Co., iron and steel merchants, of Glasgow, Scotland, has been announced.

The Vulcan Foundry Co., of Hamilton, O., has been reorganized with Howard Stevenson, of Bellefontaine, O., as secretary and treasurer, and Russell Anderson, of Hamilton, as general manager.

John M. Cason has been appointed receiver for the Lafayette Stove Foundry Co., of Lafayette, Ind., on the application of the Lafayette Engineering Co., which was awarded a judgment for $835.

The Jones & Laughlin Steel Co., Pittsburg, has purchased 1.95 acres fronting 200 feet on the Monongahela river, in that city, from the Mary E. Schenley estate for $117,088. The company has held the property under lease for many years and has had coke ovens located upon it.

Directors of the Canada Tin Plate & Sheet Steel Metal Co., Toronto, Ont., have decided to open the works at Morrisburg about Jan. 23 or 24. It is planned to make the occasion a great event in view of the fact that the plant is the first of the kind to be opened in the Dominion.

The Rockford Bolt Co., Rockford, Ill., with a $25,000 capital stock, has taken over the plant of the Rockford Bolt Works. The company will make a specialty of small forgings and special and odd shapes of bolts. The officers of the company are: President, R. H. Tinker; secretary and treasurer, C. R. Wise; assistant secretary, R. E. Messner.

The Interstate Iron & Steel Co., Chicago, began operation of the Cambridge rolling mill, Cambridge, O., Jan. 1, which it recently acquired. The mill becomes the first eastern holding of the Interstate Iron & Steel Co.

The Wheeling Steel & Iron Works, Wheeling, W. Va., is arranging for the use of coal instead of natural gas as formerly.

The Northwestern Car & Locomotive Co., Hegewisch, near Chicago, has been purchased by the Ryan Car Co. The new owners will run the plant in the most modern manner. The plant has a capacity of 10 to 15 freight cars a day and four to five locomotives a month. The officers of the company are: President, William M. Ryan; vice president and treasurer, J. M. Hopkins, and secretary, W. W. Darrow.

The Columbus Iron Store Co., Columbus, O., has opened a warehouse in that city, and expects to carry a complete line of iron and steel articles. The general offices of the company are located in the Columbus Savings & Trust building. For the present the concern will be a partnership between Frank J. Doyle and John J. Reilly, both of whom are connected with the Columbus Steam Boiler & Heater Co. Mr. Reilly is also connected with John J. Reilly & Co.

The old plant of the Indianapolis Bridge & Iron Co., Indianapolis, Ind., within a short time will be dismantled, and the proprietors will occupy a new and commodious factory now being erected at Belmont avenue and Big Four tracks. The business of the company will hereafter be conducted under the name of J. D. Adams & Co., and the output of the factory will be high-class road graders and road-making tools and machinery. In the near future the company will be in the market for a full line of suitable machinery, including lathes, planers, bulldozers, wood-working machinery, compressors, etc.

John J. Reilly & Co., Columbus, O., have been appointed sales agents for Columbus and vicinity for the Macomber & Whyte Rope Co., Chicago, and the E. G. Ripple Steel Foundry Co., of Buffalo.

The various salesmen of the Berger Mfg. Co., Canton, O., traveling direct from the home office, met Thursday, Friday and Saturday, Dec. 27, 28 and 29, at the works. The Berger factories and other Canton plants were inspected and at meetings held later talks were given by the members of the various sales departments on trade topics. W. A. King, of Chicago, delivered an address on "Scientific Salesmanship," and C. A. Irwin, secretary of the Berger Co., spoke on the "General Outlook."

The Atlas Drop Forge Co., Lansing, Mich., recently incorporated, will make a specialty of forge parts for automobiles and gas engines, marine engines, etc. Particular attention will be given to the making of large, single and multiple throw cranks. Orders for the equipment have already been placed. H. M. Bundy, formerly connected with the Springfield Drop Forge Co., Wyman & Gordon, and others, will be the superintendent, and S. H. Carpenter, of Lansing, manager and financial man. The buildings are completed and it is expected that the plant will be in operation by April 1. A feature of the buildings is seven fireproof vaults for storing dies.

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**Trade Notes:—**

The Baldwin Locomotive Works, of Chester, Pa., during the past year had the largest output of locomotives in its history, which was 2,652 engines. Of this number 201 were propelled by electric power and 2,451 by steam. Foreign countries received 281 locomotives. The figures of production from 1901 to 1905 are respectively: 1901, 1,375; 1902, 1,588; 1903, 2,022; 1904, 1,485; 1905, 2,250.

Coal and coke shipments on the Pennsylvania lines east of Pittsburg and Erie aggregated 272,949 tons for the week ending Dec. 29, showing a decrease of a quarter of a million tons as compared with previous weeks.

Ashtabula, O., port during the season of 1906 received 6,818,353 tons of iron ore, nearly 500,000 tons more than in 1905. The December receipts were 112,527 tons.